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Tomato Leaf DHS cDNA sequence

```
CGCAGAAACTCGCGGCGGCAGTCTTGTTCCGTACATAATCTTGGTCTGCAATAATGGGAGAAGCTCTGAAGTACAGTATCATGGAC
                                                    M  G  E  A  L  K  Y  S  I  M  D

TCAGTAAGATCGGTAGTTTTCAAAGAATCCGAAAATCTAGAAGGTTCTTGCACTAAAATCGAGGGCTACGACTTCAATAAAGGCGT
 S  V  R  S  V  V  F  K  E  S  E  N  L  E  G  S  C  T  K  I  E  G  Y  D  F  N  K  G  V

TAACTATGCTGAGCTGATCAAGTCCATGGTTTCCACTGGTTTCCAAGCATCTAATCTTGGTGACGCCATTGCAATTGTTAATCAAA
  N  Y  A  E  L  I  K  S  M  V  S  T  G  F  Q  A  S  N  L  G  D  A  I  A  I  V  N  Q

TGCTAGATTGGAGGCTTTCACATGAGCTGCCCACGGAGGATTGCAGTGAAGAAGAAAGAGATGTTGCATACAGAGAGTCGGTAACC
M  L  D  W  R  L  S  H  E  L  P  T  E  D  C  S  E  E  E  R  D  V  A  Y  R  E  S  V  T

TGCAAAATCTTCTTGGGGTTCACTTCAAACCTTGTTTCTTCTGGTGTTAGAGACACTGTCCGCTACCTTGTTCAGCACCGGATGGT
 C  K  I  F  L  G  F  T  S  N  L  V  S  S  G  V  R  D  T  V  R  Y  L  V  Q  H  R  M  V

TGATGTTGTGGTTACTACAGCTGGTGGTATTGAAGAGGATCTCATAAAGTGCCTCGCACCAACCTACAAGGGGGACTTCTCTTTAC
  D  V  V  V  T  T  A  G  G  I  E  E  D  L  I  K  C  L  A  P  T  Y  K  G  D  F  S  L

CTGGAGCTTCTCTACGATCGAAAGGATTGAACCGTATTGGTAACTTATTGGTTCCTAATGACAACTACTGCAAATTTGAGAATTGG
P  G  A  S  L  R  S  K  G  L  N  R  I  G  N  L  L  V  P  N  D  N  Y  C  K  F  E  N  W

ATCATCCCAGTTTTTGACCAAATGTATGAGGAGCAGATTAATGAGAAGGTTCTATGGACACCATCTAAAGTCATTGCTCGTCTGGG
 I  I  P  V  F  D  Q  M  Y  E  E  Q  I  N  E  K  V  L  W  T  P  S  K  V  I  A  R  L  G
```

FIG.1A

```
TAAAGAAATTAATGATGAAACCTCATACTTGTATTGGGCTTACAAGAACCGGATTCCTGTCTTCTGTCCTGGCTTGACGGATGGAT
  K  E  I  N  D  E  T  S  Y  L  Y  W  A  Y  K  N  R  I  P  V  F  C  P  G  L  T  D  G

CACTTGGTGACATGCTATACTTCCATTCTTTCAAAAAGGGTGATCCAGATAATCCAGATCTTAATCCTGGTCTAGTCATAGACATT
S  L  G  D  M  L  Y  F  H  S  F  K  K  G  D  P  D  N  P  D  L  N  P  G  L  V  I  D  I

GTAGGAGATATTAGGGCCATGAATGGTGAAGCTGTCCATGCTGGTTTGAGGAAGACAGGAATGATTATACTGGGTGGAGGGCTGCC
 V  G  D  I  R  A  M  N  G  E  A  V  H  A  G  L  R  K  T  G  M  I  I  L  G  G  G  L  P

TAAGCACCATGTTTGCAATGCCAATATGATGCGCAATGGTGCAGATTTTGCCGTCTTCATTAACACCGCACAAGAGTTTGATGGTA
  K  H  H  V  C  N  A  N  M  M  R  N  G  A  D  F  A  V  F  I  N  T  A  Q  E  F  D  G

GTGACTCTGGTGCCCGTCCTGATGAAGCTGTATCATGGGGAAAGATACGTGGTGGTGCCAAGACTGTGAAGGTGCATTGTGATGCA
S  D  S  G  A  R  P  D  E  A  V  S  W  G  K  I  R  G  G  A  K  T  V  K  V  H  C  D  A

ACCATTGCATTTCCCATATTAGTAGCTGAGACATTTGCAGCTAAGAGTAAGGAATTCTCCCAGATAAGGTGCCAAGTTTGAACATT
 T  I  A  F  P  I  L  V  A  E  T  F  A  A  K  S  K  E  F  S  Q  I  R  C  Q  V

GAGGAAGCTGTCCTTCCGACCACACATATGAATTGCTAGCTTTTGAAGCCAACTTGCTAGTGTGCAGCACCATTTATTCTGCAAAA
CTGACTAGAGAGCAGGGTATATTCCTCTACCCCGAGTTAGACGACATCCTGTATGGTTCAAATTAATTATTTTTCTCCCCTTCACA
CCATGTTATTTAGTTCTCTTCCTCTTCGAAAGTGAAGAGCTTAGATGTTCATAGGTTTTGAATTATGTTGGAGGTTGGTGATAACT
GACTAGTCCTCTTACCATATAGATAATGTATCCTTGTACTATGAGATTTTGGGTGTGTTTGATACCAAGGAAAAATGTTTATTTGG
AAAACAATTGGATTTTTAATTTATTTTTTCTTGTTT
```

FIG.1B

Arabidopsis DeoxyHypusine Synthase
(DHS) Predicted Sequence

```
GAACTCCCAAAACCCTCTACTACTACACTTTCAGATCCAAGGAAATCAATTTTGTCATTCGAGCAACATGG
                                                                  M
AGGATGATCGTGTTTTCTCTTCGGTTCACTCAACAGTTTTCAAAGAATCCGAATCATTGGAAGGAAAGTGT
E  D  D  R  V  F  S  S  V  H  S  T  V  F  K  E  S  E  S  L  E  G  K  C
GATAAAATCGAAGGATACGATTTCAATCAAGGAGTAGATTACCCAAAGCTTATGCGATCCATGCTCACCAC
 D  K  I  E  G  Y  D  F  N  Q  G  V  D  Y  P  K  L  M  R  S  M  L  T  T
CGGATTTCAAGCCTCGAATCTCGGCGAAGCTATTGATGTCGTCAATCAAATGGTTCGTTTCTCGAATTCAT
  G  F  Q  A  S  N  L  G  E  A  I  D  V  V  N  Q  M
CAAAAATAAAAATTCCTTCTTTTTGTTTTCCTTTGTTTTGGGTGAATTAGTAATGACAAAGAGTTTGAATT
                                                                F  E  F
TGTATTGAAGCTAGATTGGAGACTGGCTGATGAAACTACAGTAGCTGAAGACTGTAGTGAAGAGGAGAAGA
  V  L  K  L  D  W  R  L  A  D  E  T  T  V  A  E  D  C  S  E  E  E  K
ATCCATCGTTTAGAGAGTCTGTCAAGTGTAAAATCTTTCTAGGTTTCACTTCAAATCTTGTTTCATCTGGT
N  P  S  F  R  E  S  V  K  C  K  I  F  L  G  F  T  S  N  L  V  S  S  G
GTTAGAGATACTATTCGTTATCTTGTTCAGCATCATATGGTTTGTGATTTTTGCTTTATCACCCTGCTTTT
 V  R  D  T  I  R  Y  L  V  Q  H  H  M
TTATAGATGTTAAAATTTTCGAGCTTTAGTTTTGATTTCAATGGTTTTTCTGCAGGTTGATGTTATAGTCA
                                                        V  D  V  I  V
CGACAACTGGTGGTGTTGAGGAAGATCTCATAAAATGCCTTGCACCTACATTTAAAGGTGATTTCTCTCTA
T  T  T  G  G  V  E  E  D  L  I  K  C  L  A  P  T  F  K  G  D  F  S  L
CCTGGAGCTTATTTAAGGTCAAAGGGATTGAACCGAATTGGGAATTTGCTGGTTCCTAATGATAACTACTG
 P  G  A  Y  L  R  S  K  G  L  N  R  I  G  N  L  L  V  P  N  D  N  Y  C
CAAGTTTGAGGATTGGATCATTCCCATCTTTGACGAGATGTTGAAGGAACAGAAAGAAGAGGTATTGCTTT
  K  F  E  D  W  I  I  P  I  F  D  E  M  L  K  E  Q  K  E  E
ATCTTTCCTTTTTATATGATTTGAGATGATTCTGTTTGTGCGTCACTAGTGGAGATAGATTTTGATTCCTC
TCTTGCATCATTGACTTCGTTGGTGAATCCTTCTTTCTCTGGTTTTTCCTTGTAGAATGTGTTGTGGACTC
                                                        N  V  L  W  T
CTTCTAAACTGTTAGCACGGCTGGGAAAAGAAATCAACAATGAGAGTTCATACCTTTATTGGGCATACAAG
P  S  K  L  L  A  R  L  G  K  E  I  N  N  E  S  S  Y  L  Y  W  A  Y  K
GTATCCAAAATTTTAACCTTTTTAGTTTTTTAATCATCCTGTGAGGAACTCGGGGATTTAAATTTTCCGCT
TCTTGTGGTGTTTGTAGATGAATATTCCAGTATTCTGCCCAGGGTTAACAGATGGCTCTCTTGGGGATATG
                        M  N  I  P  V  F  C  P  G  L  T  D  G  S  L  G  D  M
CTGTATTTTCACTCTTTTCGTACCTCTGGCCTCATCATCGATGTAGTACAAGGTACTTCTTTTACTCAATA
 L  Y  F  H  S  F  R  T  S  G  L  I  I  D  V  V  Q
AGTCAGTGTGATAAATATTCCTGCTACATCTAGTGCAGGAATATTGTAACTAGTAGTGCATTGTAGCTTTT
CCAATTCAGCAACGGACTTTACTGTAAGTTGATATCTAAAGGTTCAAACGGGAGCTAGGAGAATAGCATAG
GGGCATTCTGATTTAGGTTTGGGGCACTGGGTTAAGAGTTAGAGAATAATAATCTTGTTAGTTGTTTATCA
AACTCTTTGATGGTTAGTCTCTTGGTAATTTGAATTTTATCACAGTGTTTATGGTCTTTGAACCAGTTAAT
GTTTTATGAACAGATATCAGAGCTATGAACGGCGAAGCTGTCCATGCAAATCCTAAAAAGACAGGGATGAT
                  D  I  R  A  M  N  G  E  A  V  H  A  N  P  K  K  T  G  M  I
AATCCTTGGAGGGGGCTTGCCAAAGCACCACATATGTAATGCCAATATGATGCGCAATGGTGCAGATTACG
  I  L  G  G  G  L  P  K  H  H  I  C  N  A  N  M  M  R  N  G  A  D  Y
CTGTATTTATAAACACCGGGCAAGAATTTGATGGGAGCGACTCGGGTGCACGCCCTGATGAAGCCGTGTCT
A  V  F  I  N  T  G  Q  E  F  D  G  S  D  S  G  A  R  P  D  E  A  V  S
TGGGGTAAAATTAGGGGTTCTGCTAAAACCGTTAAGGTCTGCTTTTTAATTTCTTCACATCCTAATTTATA
 W  G  K  I  R  G  S  A  K  T  V  K  V  C  F  L  I  S  S  H  P  N  L  Y
TCTCACTCAGTGGTTTTGAGTACATATTTAATATTGGATCATTCTTGCAGGTATACTGTGATGCTACCATA
  L  T  Q  W  F
GCCTTCCCATTGTTGGTTGCAGAAACATTTGCCACAAAGAGAGACCAAACCTGTGAGTCTAAGACTTAAGA
ACTGACTGGTCGTTTTGGCCATGGATTCTTAAAGATCGTTGCTTTTTGATTTTACACTGGAGTGACCATAT
AACACTCCACATTGATGTGGCTGTGACGCGAATTGTCTTCTTGCGAATTGTACTTTAGTTTCTCTCAACCT
AAAATGATTTGCAGATTGTGTTTTCGTTTAAAACACAAGAGTCTTGTAGTCAATAATCCTTTGCCTTATAA
AATTATTCAGTTCCAACAACACATTGTGATTCTGTGACAAGTCTCCCGTTGCCTATGTTCACTTCTCTGCG
```

FIG.2A

MEDDRVFSSVHSTVFKESESLEGKCDKIEGYDFNQGVDYPKLMRSMLTTGFQASNLGEAIDVVNQMFEFVLKLDWRLADETTV
AEDCSEEEKNPSFRESVKCKIFLGFTSNLVSSGVRDTIRYLVQHHMVDVIVTTTGGVEEDLIKCLAPTFKGDFSLPGAYLRSK
GLNRIGNLLVPNDNYCKFEDWIIPIFDEMLKEQKEENVLWTPSKLLARLGKEINNESSYLYWAYKMNIPVFCPGLTDGSLGDM
LYFHSFRTSGLIIDVVQDIRAMNGEAVHANPKKTGMIILGGGLPKHHICNANMMRNGADYAVFINTGQEFDGSDSGARPDEAV
SWGKIRGSAKTVKVCFLISSHPNLYLTQWF

FIG.2B

GGTGGTGTTGAGGAAGATCTCATAAAATGCCTTGCACCTACATTTAAAGGTGATTTCTCTCTACCTGGAGCTTATTTAAG
GTCAAAGGGATTGAACCGAATTGGGAATTTGCTGGTTCCTAATGATAACTACTGCAAGTTTGAGGATTGGATCATTCCCA
TCTTTGACGAGATGTTGAAGGAACAGAAAGAAGAGAATGTGTTGTGGACTCCTTCTAAACTGTTAGCACGGCTGGGAAAA
GAAATCAACAATGAGAGTTCATACCTTTATTGGGCATACAAGATGAATATTCCAGTATTCTGCCCAGGGTTAACAGATGG
CTCTCTTAGGGATATGCTGTATTTTCACTCTTTTCGTACCTCTGGCCTCATCATCGATGTAGTACAAGATATCAGAGCTA
TGAACGGCGAAGCTGTCCATGCAAATCCTAAAAAAGACAGGGATGATAATCCTTGGAGGGGGCTTGCCAAAGCACCACATA
TGTAATGCCAATATGATGCGCAATGGTGCAGATTACGCTGTATTTATAAACACCGGGCAAGAATTTGATGGGAGCGACTC
GGGTGCACGCCCTGATGAAGC

FIG.2C

GGVEEDLIKCLAPTFKGDFSLPGAYLRSKGLNRIGNLLVPNDNYCKFEDWIIPIFDEMLKEQKEENVLWTPSKLLARLGKEIN
NESSYLYWAYKMNIPVFCPGLTDGSLRDMLYFHSFRTSGLIIDVVQDIRAMNGEAVHANPKKTGMIILGGGLPKHHICNANMM
RNGADYAVFINTGQEFDGSDSGARPDE

FIG.2D

Multiple DHS Sequence Alignments of
Human, Arabidopsis, Tomato, Yeast, Neurospora (Fungi), and
Methanococcus (Archaeobacteria)

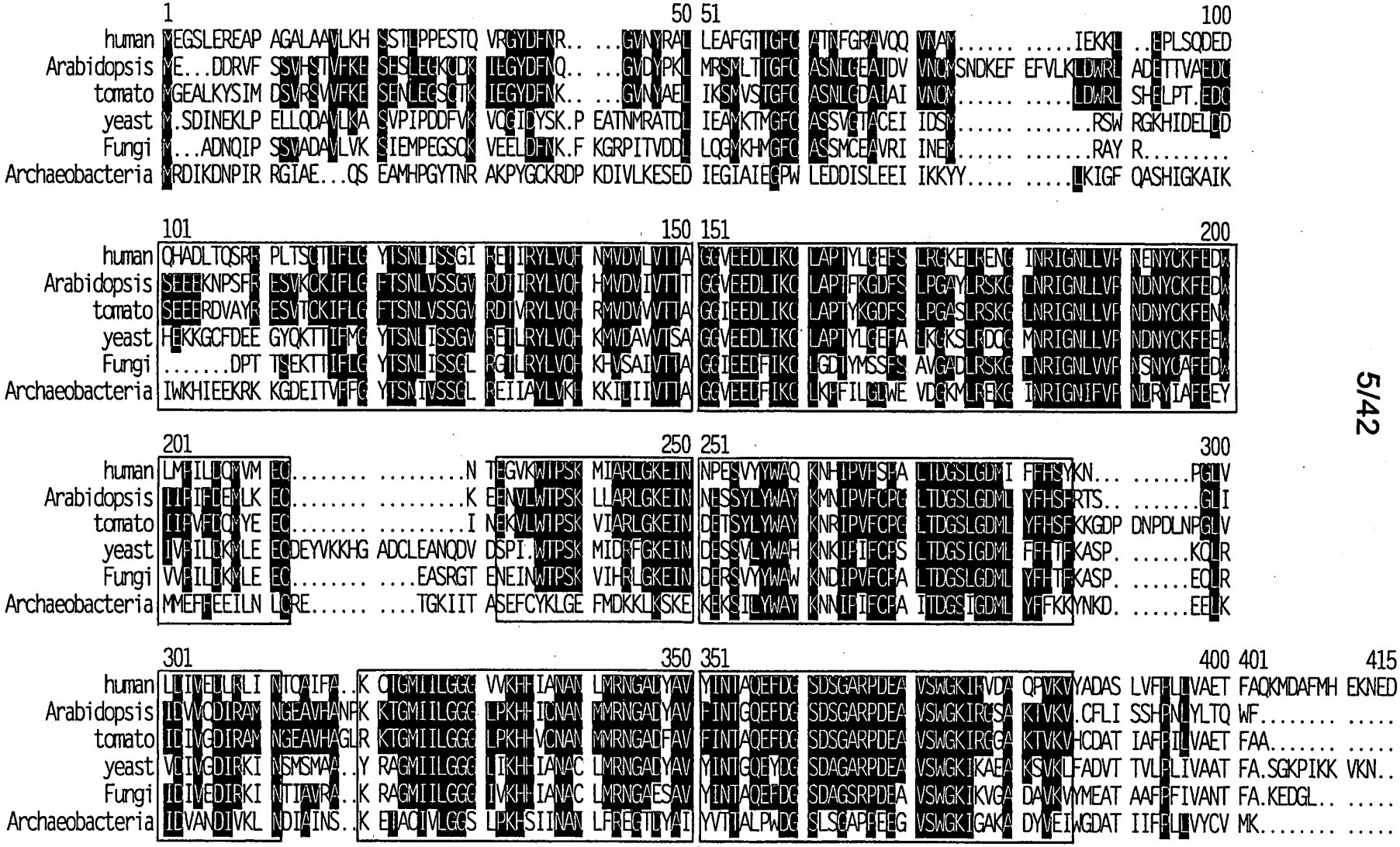

FIG.3

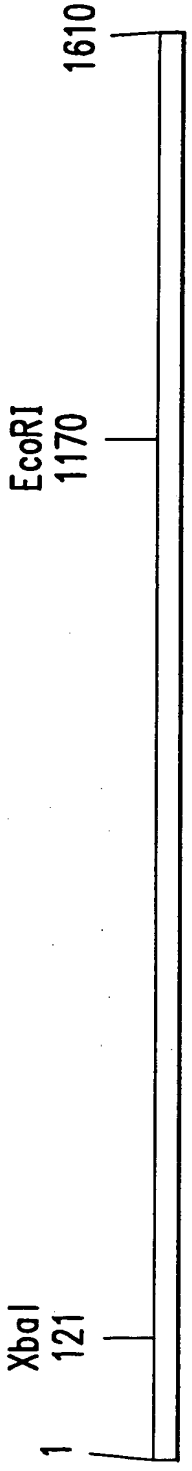

FIG.4

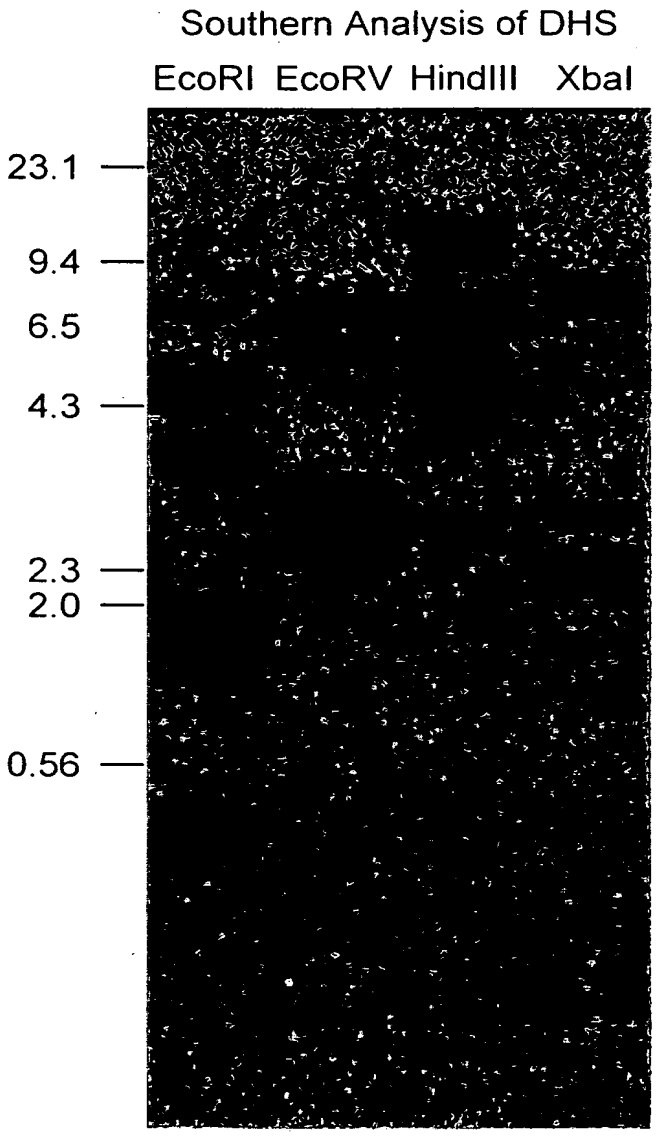

FIG.5

Northern analysis of DHS on tomato flowers

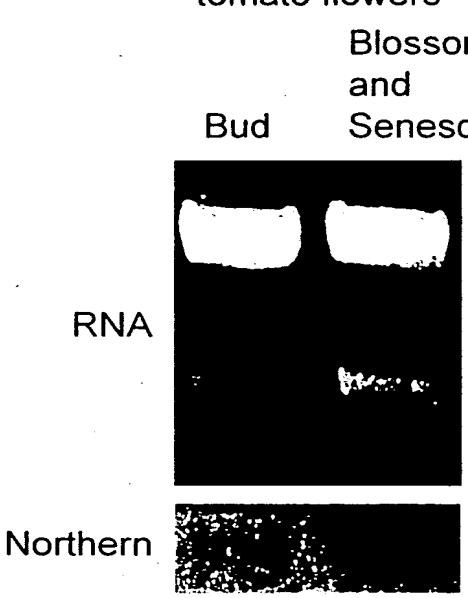

FIG.6

NORTHERN ANALYSIS OF DHS ON DEVELOPMENTAL STAGES OF TOMATO FRUIT

BREAKER PINK

RIPE (RED)

NORTHERN BLOT

FIG. 7

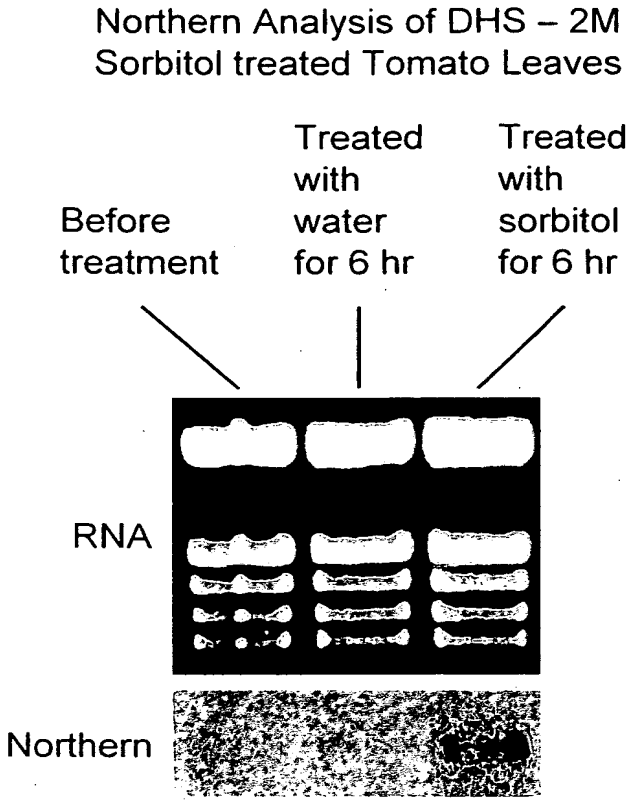

FIG.8

NORTHERN ANALYSIS OF DHS
TOMATO LEAF CHILLING EFFECTS

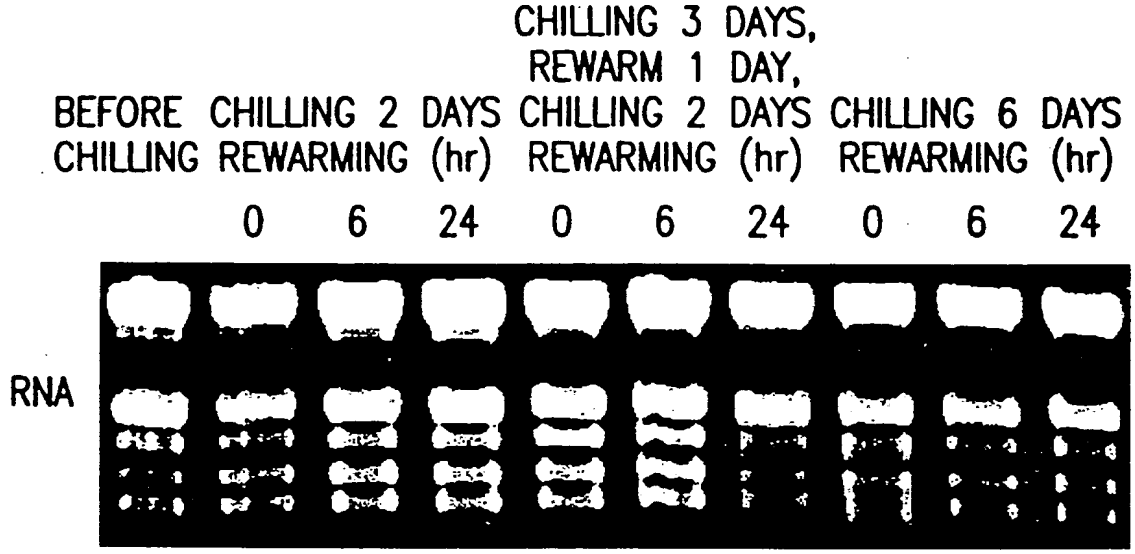

FIG.9A

FIG.9B

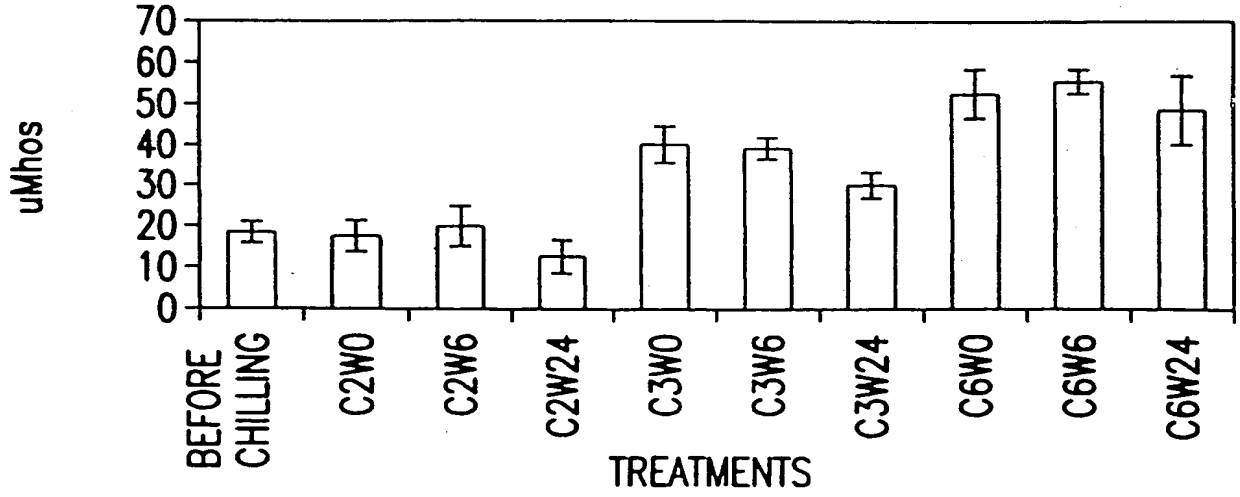

FIG.9C

Canation DHS cDNA Sequence

```
GTCATTACAATGCATAGGATCATTGCACATGCTACCTTCCTCATTGCACTTGAGCTTGCCATA
CTTTTGTTTTTGACGTTTGATAATAATACTATGAAAATATTATGTTTTTTCTTTTGTGTGTTG
GTGTTTTTGAAGTTGTTTTTGATAAGCAGAACCCAGTTGTTTTACACTTTTACCATTGAACTA
CTGCAATTCTAAAACTTTGTTTACATTTTAATTCCATCAAAGATTGAGTTCAGCATAGGAAAA
AGGATGGAGGATGCTAATCATGATAGTGTGGCATCTGCGCACTCTGCAGCATTCAAAAAGTCG
    M  E  D  A  N  H  D  S  V  A  S  A  H  S  A  A  F  K  K  S
GAGAATTTAGAGGGGAAAAGCGTTAAGATTGAGGGTTATGATTTTAATCAAGGTGTAAACTAT
 E  N  L  E  G  K  S  V  K  I  E  G  Y  D  F  N  Q  G  V  N  Y
TCCAAACTCTTGCAATCTTTCGCTTCTAATGGGTTTCAAGCCTCGAATCTTGGAGATGCCATT
 S  K  L  L  Q  S  F  A  S  N  G  F  Q  A  S  N  L  G  D  A  I
GAAGTAGTTAATCATATGCTAGATTGGAGTCTGGCAGATGAGGCACCTGTGGACGATTGTAGC
 E  V  V  N  H  M  L  D  W  S  L  A  D  E  A  P  V  D  D  C  S
GAGGAAGAGAGGGATCCTAAATTCAGAGAATCTGTGAAGTGCAAAGTGTTCTTGGGCTTTACT
 E  E  E  R  D  P  K  F  R  E  S  V  K  C  K  V  F  L  G  F  T
TCAAATCTTATTTCCTCTGGTGTTCGTGACACAATTCGGTATCTCGTGCAACATCATATGGTT
 S  N  L  I  S  S  G  V  R  D  T  I  R  Y  L  V  Q  H  H  M  V
GACGTGATAGTAACGACAACCGGAGGTATAGAAGAAGATCTAATAAAAGGAAGATCCATCAAG
 D  V  I  V  T  T  T  G  G  I  E  E  D  L  I  K  G  R  S  I  K
TGCCTTGCACCCACTTTCAAAGGCGATTTTGCCTTACCAGGAGCTCAATTACGCTCCAAAGGG
 C  L  A  P  T  F  K  G  D  F  A  L  P  G  A  Q  L  R  S  K  G
TTGAATCGAATTGGTAATCTGTTGGTTCCGAATGATAACTACTGTAAATTTGAGGATTGGATC
 L  N  R  I  G  N  L  L  V  P  N  D  N  Y  C  K  F  E  D  W  I
ATTCCAATTTTAGATAAGATGTTGGAAGAGCAAATTTCAGAGAAAATCTTATGGACACCATCG
 I  P  I  L  D  K  M  L  E  E  Q  I  S  E  K  I  L  W  T  P  S
AAGTTGATTGGTCGATTAGGAAGAGAAATAAACGATGAGAGTTCATACCTTTACTGGGCCTTC
 K  L  I  G  R  L  G  R  E  I  N  D  E  S  S  Y  L  Y  W  A  F
AAGAACAATATTCCAGTATTTTGCCCAGGTTTAACAGACGGCTCACTCGGAGACATGCTATAT
 K  N  N  I  P  V  F  C  P  G  L  T  D  G  S  L  G  D  M  L  Y
TTTCATTCTTTTCGCAATCCGGGTTTAATCGTCGATGTTGTGCAAGATATAAGAGCAGTAAAT
 F  H  S  F  R  N  P  G  L  I  V  D  V  V  Q  D  I  R  A  V  N
GGCGAGGCTGTGCACGCAGCGCCTAGGAAAACAGGCATGATTATACTCGGTGGAGGGTTGCCT
 G  E  A  V  H  A  A  P  R  K  T  G  M  I  I  L  G  G  G  L  P
AAGCACCACATCTGCAACGCAAACATGATGAGAAATGGCGCCGATTATGCTGTTTTCATCAAC
 K  H  H  I  C  N  A  N  M  M  R  N  G  A  D  Y  A  V  F  I  N
ACTGCCGAAGAGTTTGACGGCAGTGATTCTGGTGCTCGCCCCGATGAGGCTATTTCATGGGGC
 T  A  E  E  F  D  G  S  D  S  G  A  R  P  D  E  A  I  S  W  G
AAAATTAGCGGATCTGCTAAGACTGTGAAGGTGCATTGTGATGCCACGATAGCTTTCCCTCTA
 K  I  S  G  S  A  K  T  V  K  V  H  C  D  A  T  I  A  F  P  L
CTAGTCGCTGAGACATTTGCAGCAAAAAGAGAAAAAGAGAGGAAGAGCTGTTAAAACTTTTTT
 L  V  A  E  T  F  A  A  K  R  E  K  E  R  K  S  C
GATTGTTGAAAAATCTGTGTTATACAAGTCTCGAAATGCATTTTAGTAATTGACTTGATCTTA
TCATTTCAATGTGTTATCTTTGAAAATGTTGGTAATGAAACATCTCACCTCTTCTATACAACA
TTGTTGATCCATTGTACTCCGTATCTTGTAATTTTGGAAAAAAAAAAACCGTCTATTGTTACGA
GAGAGTACATTTTTGAGGTAAAAATATAGGATTTTTGTGCGATGCAAATGCTGGTTATTCCCT
TGAAAAAAAAAAAAAAAAAAAA
```

(1384 bps, not include Poly A tail and 5'end nocoding region.
373 Amino Acid.)

FIG.10

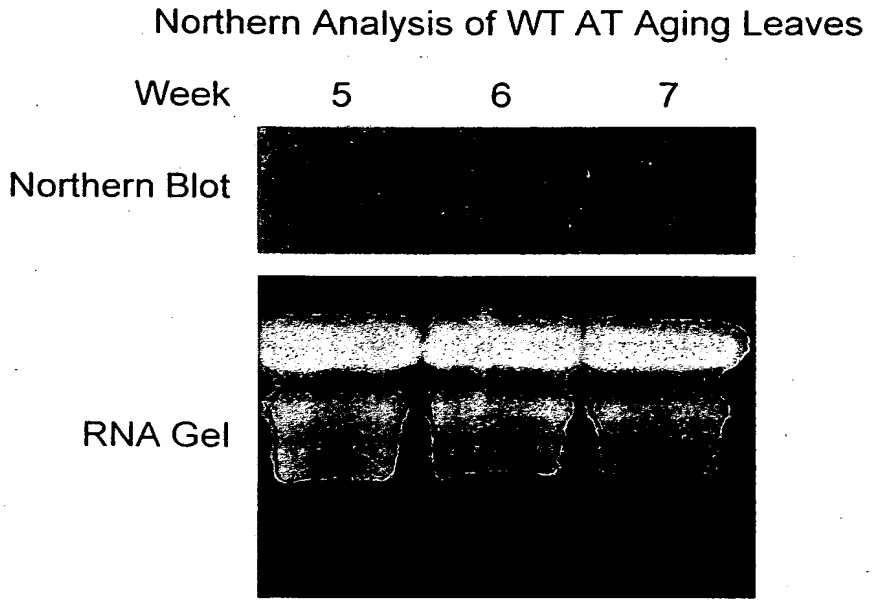

FIG.11

Northern Analysis of Canation Petal *(In Situ)* DHS

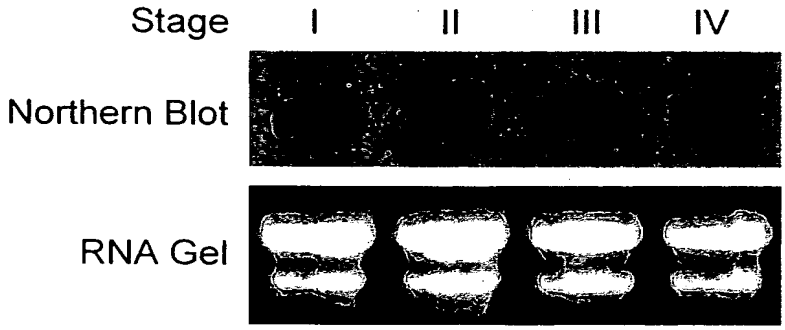

FIG.12

Tomato eif5A

AAAGAATCCTAGAGAGAGAAAGGGAATCCTAGAGAGAGAAGC**ATG**TCGGACGAAGAACAC
M S D E E H
CATTTTGAGTCAAAGGCAGATGCTGGTGCCTCAAAAACTTTCCCACAGCAAGCTGGAACC
H F E S K A D A G A S K T F P Q Q A G T
ATCCGTAAGAATGGTTACATCGTTATCAAAGGCCGTCCCTGCAAGGTTGTTGAGGTCTCC
I R K N G Y I V I K G R P C K V V E V S
ACTTCAAAAACTGGAAAACACGGACATGCTAAATGTCACTTTGTGGCAATTGACATTTTC
T S K T G K H G H A K C H F V A I D I F
AATGGAAAGAAACTGGAAGATATCGTTCCGTCCTCCCACAATTGTGATGTGCCACATGTT
N G K K L E D I V P S S H N C D V P H V
AACCGTACCGACTATCAGCTGATTGATATCTCTGAAGATGGTTTTGTCTCACTTCTTACT
N R T D Y Q L I D I S E D G F V S L L T
GAAAGTGGAAACACCAAGGATGACCTCAGGCTTCCCACCGATGAAAATCTGCTGAAGCAG
E S G N T K D D L R L P T D E N L L K Q
GTTAAAGATGGGTTCCAGGAAGGAAAGGATCTTGTGGTGTCTGTTATGTCTGCGATGGGC
V K D G F Q E G K D L V V S V M S A M G
GAAGAGCAGATTAACGCCGTTAAGGATGTTGGTACCAAGAAT**TAG**TTATGTCATGGCAGC
E E Q I N A V K D V G T K N
ATAATCACTGCCAAAGCTTTAAGACATTATCATATCCTAATGTGGTACTTTGATATCACT
AGATTATAAACTGTGTTATTTGCACTGTTCAAAACAAAAGAAAGAAAACTGCTGTTATGG
CTAGAGAAAGTATTGGCTTTGAGCTTTTGACAGCACAGTTGAACTATGTGAAAATTCTAC
TTTTTTTTTTTTGGGTAAAATACTGCTCGTTTAATGTTTTGCAAAAAAAAAAAAAAAAAA

764 bps, not: including Poly(A) tail; 160 amino acids

FIG.13

Carnation-F5A

CTCTTTTACATCAATCGAAAAAAAATTAGGGTTCTTATTTTAGAGTGAGA

GGCGAAAAATCGAACGATGTCGGACGACGATCACCATTTCGAGTCATCGG
M S D D D H H F E S S A
CCGACGCCGGAGCATCCAAGACTTACCCTCAACAAGCTGGTACAATCCGC
D A G A S K T Y P Q Q A G T I R
AAGAGCGGTCACATCGTCATCAAAAATCGcCCtTGCAAGGtGGTTGAGGT
K S G H I V I K N R P C K V V E V
TTCTACCTCCAAGACTGGCAAGCACGGTCATGCCAAATGTCACTTTGTTG
S T S K T G K H G H A K C H F V A
CCATTGACATTTTCAACGGCAAGAAGCTGGAAGATATTGTCCCCTCATCC
I D I F N G K K L E D I V P S S
CACAATTGTGATGTTCCACATGTCAACCGTGTCGACTACCAGCTGCTTGA
H N C D V P H V N R V D Y Q L L D
TATCACTGAAGATGGCTTTCTTAGTCTGCTGACTGACAGTGGTGACACCA
I T E D G F V S L L T D S G D T K
AGGATGATCTGAAGCTTCCTGCTGATGAGGCCCTTGTGAAGCAGATGAAG
D D L K L P A D E A L V K Q M K
GAGGGATTTGAGGCGGGGAAAGACTTGATTCTGTCAGTCATGTGTGCAAT
E G F E A G K D L I L S V M C A M
GGGAGAAGAGCAGATCTGCGCCGTCAAGGACGTTAGTGGTGGCAAGTAGA
G E E Q I C A V K D V S G G K
AGCTTTTGATGAATCCAATACTACGCGGTGCAGTTGAAGCAATAGTAATC
TCGAGAACATTCTGAACCTTATATGTTGAATTGATGGTGCTTAGTTTGTT
TTGGAAATCTCTTTGCAATTAAGTTGTACCAAATCAATGGATGTAATGTC
TTGAATTTGTTTTATTTTTGTTTTGATGTTTGCTGtGATTGCATTATGCA
TTGTTATGAGTTATGACCTGTTATAACACAAGGTTTTGGTAAAAAAAAAA
AAAAAAAAAAAA

790 bps, 160 amino acids

FIG.14

Arabidopsis F5A

CTGTTACCAAAAAATCTGTACCGCAAAATCCTCGTCGAAGCTCGCTGCTGCAACC**ATG**TC
M S
CGACGAGGAGCATCACTTTGAGTCCAGTGACGCCGGAGCGTCCAAAACCTACCCTCAACA
D E E H H F E S S D A G A S K T Y P Q Q
AGCTGGAACCATCCGTAAGAATGGTTACATCGTCATC**AAAAATCGTCCCTGCAAGGT**TGT
A G T I R K N G Y I V I K N R P C K V V
TGAGGTTTCAACCTCGAAGACTGGCAAGCATGGTCATGCTAAATGTCATTTTGTAGCTAT
E V S T S K T G K H G H A K C H F V A I
TGATATCTTCACCAGCAAGAAACTCGAAGATATTGTTCCTTCTTCCCACAATTGTGATGT
D I F T S K K L E D I V P S S H N C D V
TCCTCATGTCAACCGTACTGATTATCAGCTGATTGACATTTCTGAAGATGGATATGTCAG
P H V N R T D Y Q L I D I S E D G Y V S
TTTGTTGACTGATAACGGTAGTACCAAGGATGACCTTAAGCTCCCTAATGATGACACTCT
L L T D N G S T K D D L K L P N D D T L
GCTCCAACAGATCAAGAGT**GGGTTTGATGATGGAAAAGA**TCTAGTGGTGAGTGTAATGTC
L Q Q I K S G F D D G K D L V V S V M S
AGCTATGGGAGAGGAACAGATCAATGCTCTTAAGGACATCGGTCCCAAG**TGA**GACTAACA
A M G E E Q I N A L K D I G P K
AAGCCTCCCCTTTGTTATGAGATTCTTCTTCTTCTGTAGGCTTCCATTACTCGTCGGAGA
TTATCTTGTTTTTGGGTTACTCCTATTTTGGATATTTAAACTTTTGTTAATAATGCCATC
TTCTTCAACCTTTTCCTTCTAGATGGTTTTTATACTTCTTCT

754 bps, not including Poly(A) tail; 158 amino acids

FIG.15

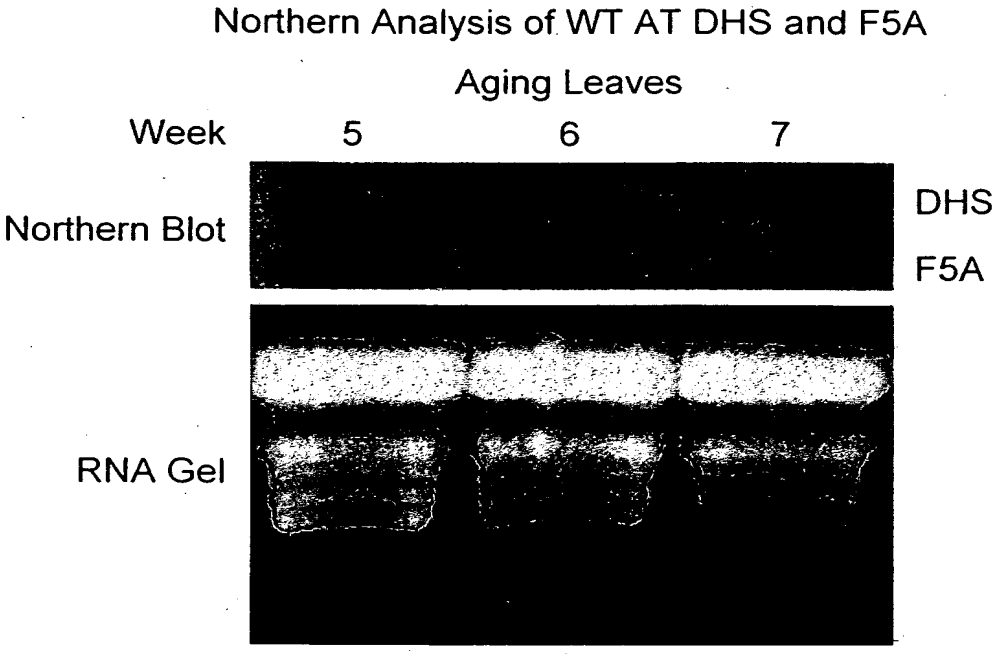

FIG.16

Northern Analysis of Ripening Tomato Fruit

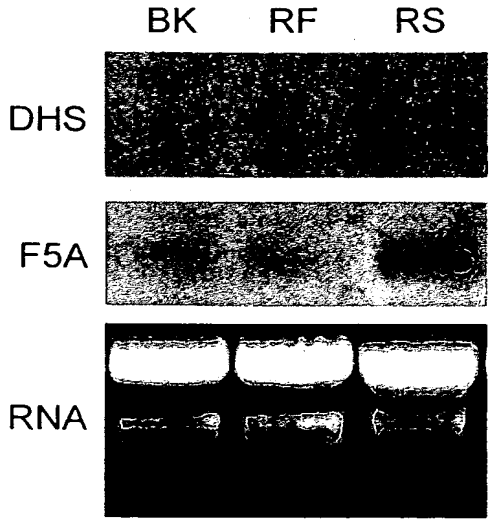

FIG. 17

Northern Analysis of sorbitol-treated tomato leaves

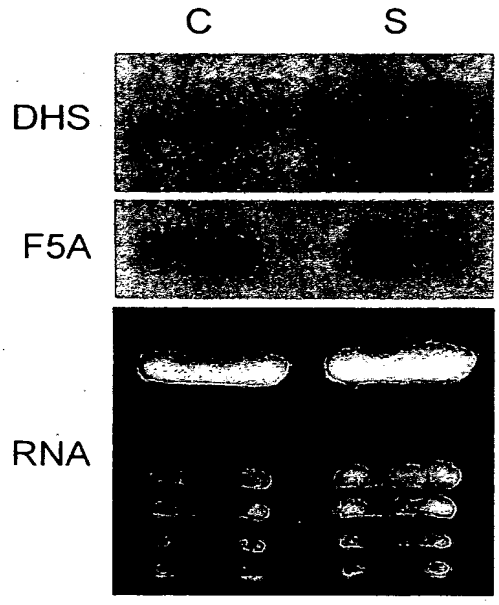

FIG.18

Northern Analysis of Tomato Flowers

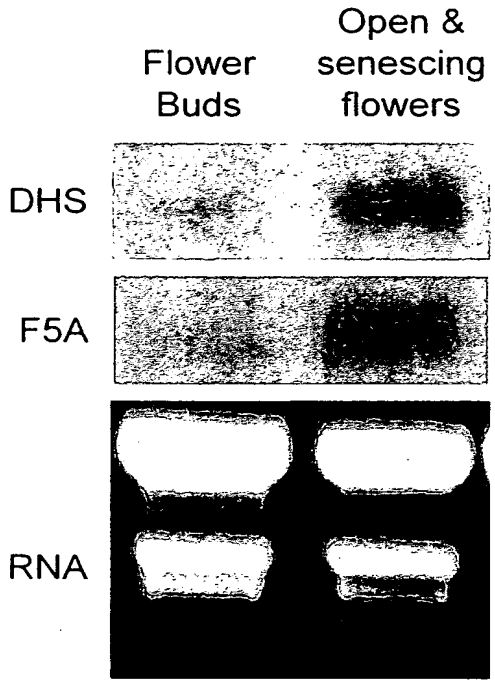

FIG. 19

Northern Analysis of chill-injured tomato leaves

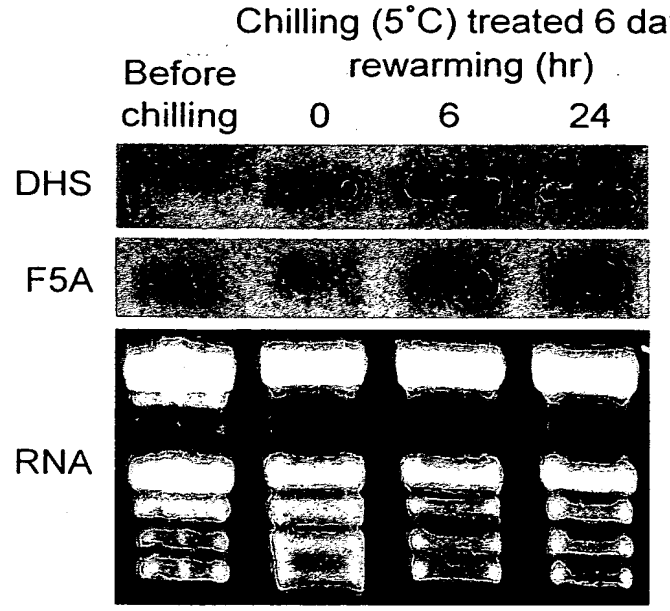

FIG.20

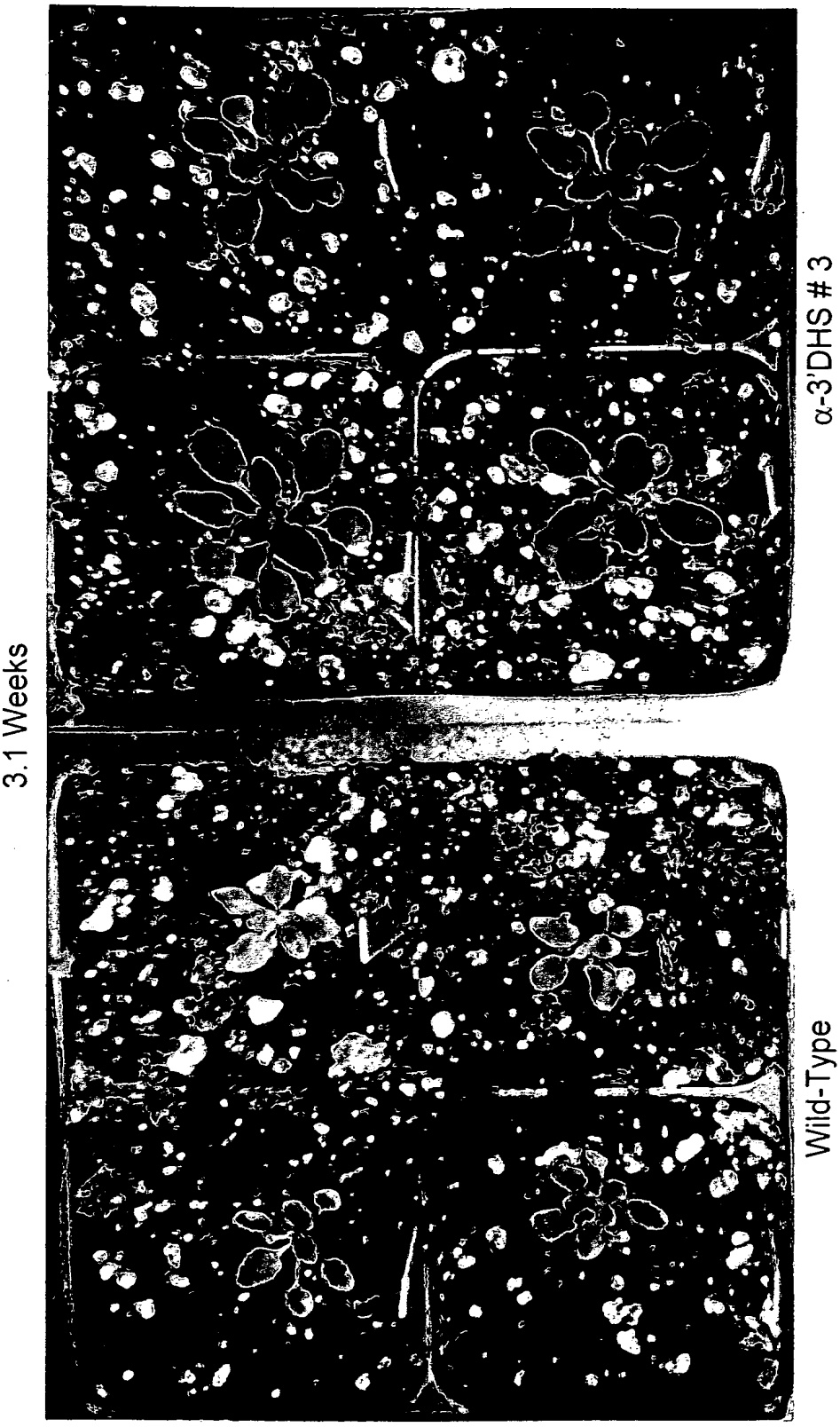

FIG.21

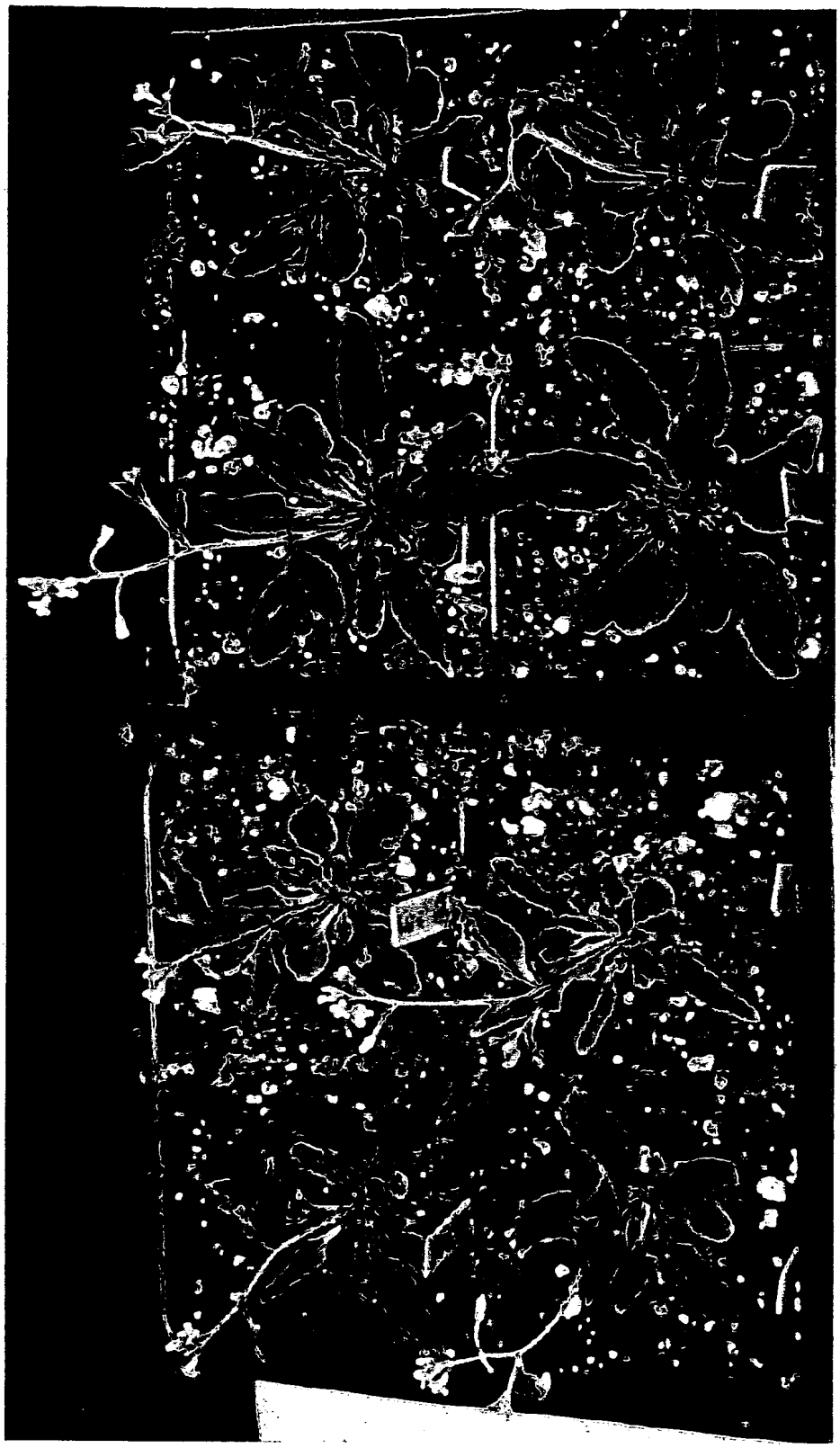

FIG. 22

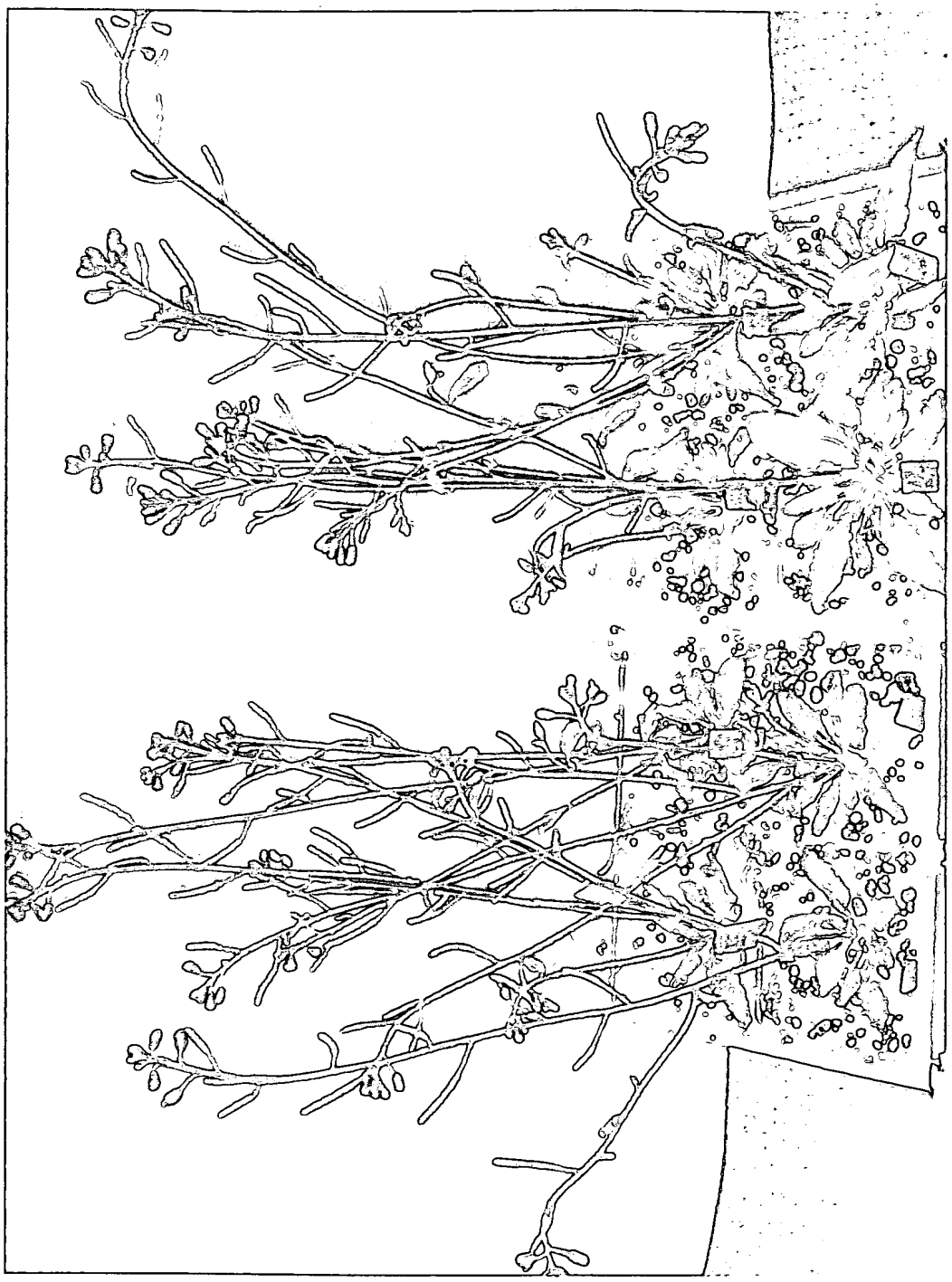

FIG. 23

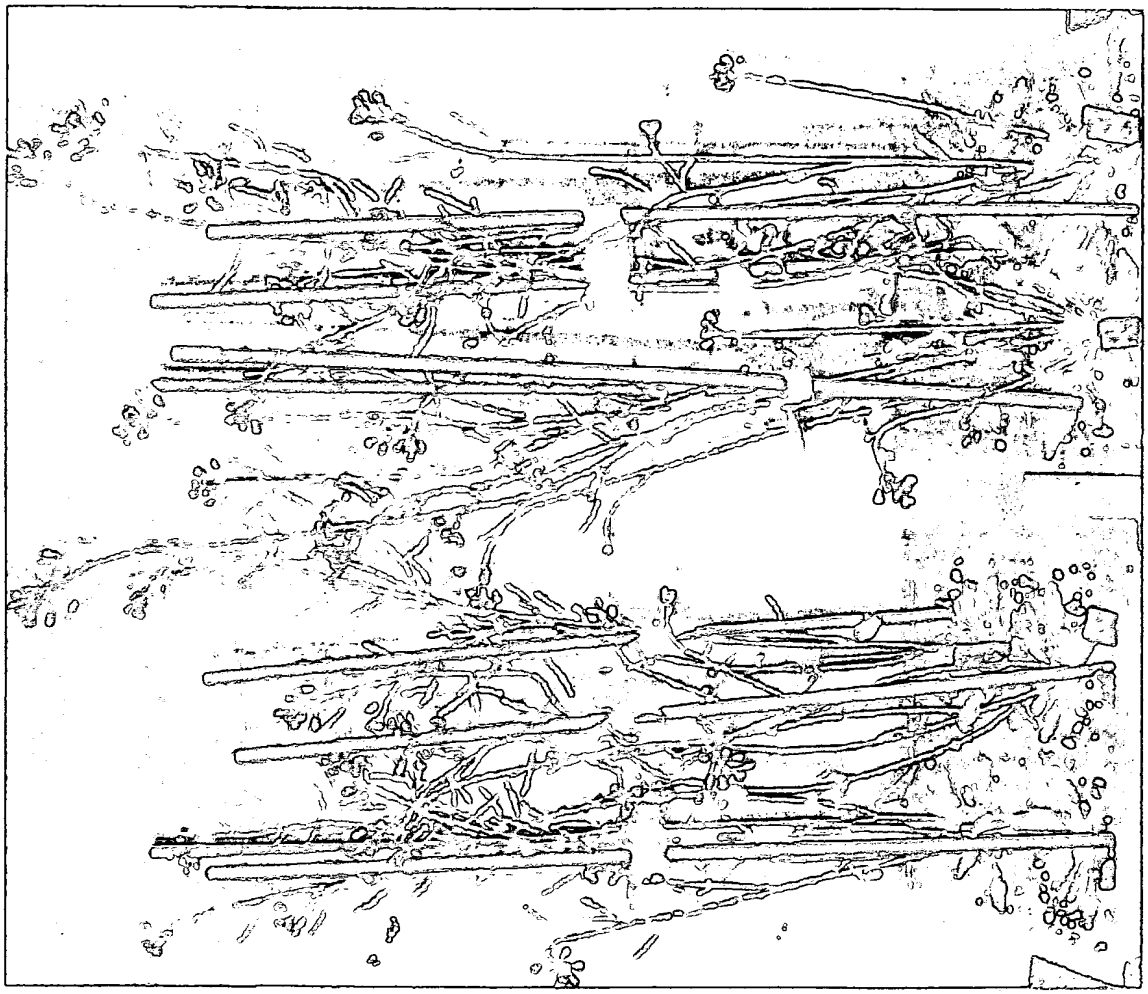

FIG. 24

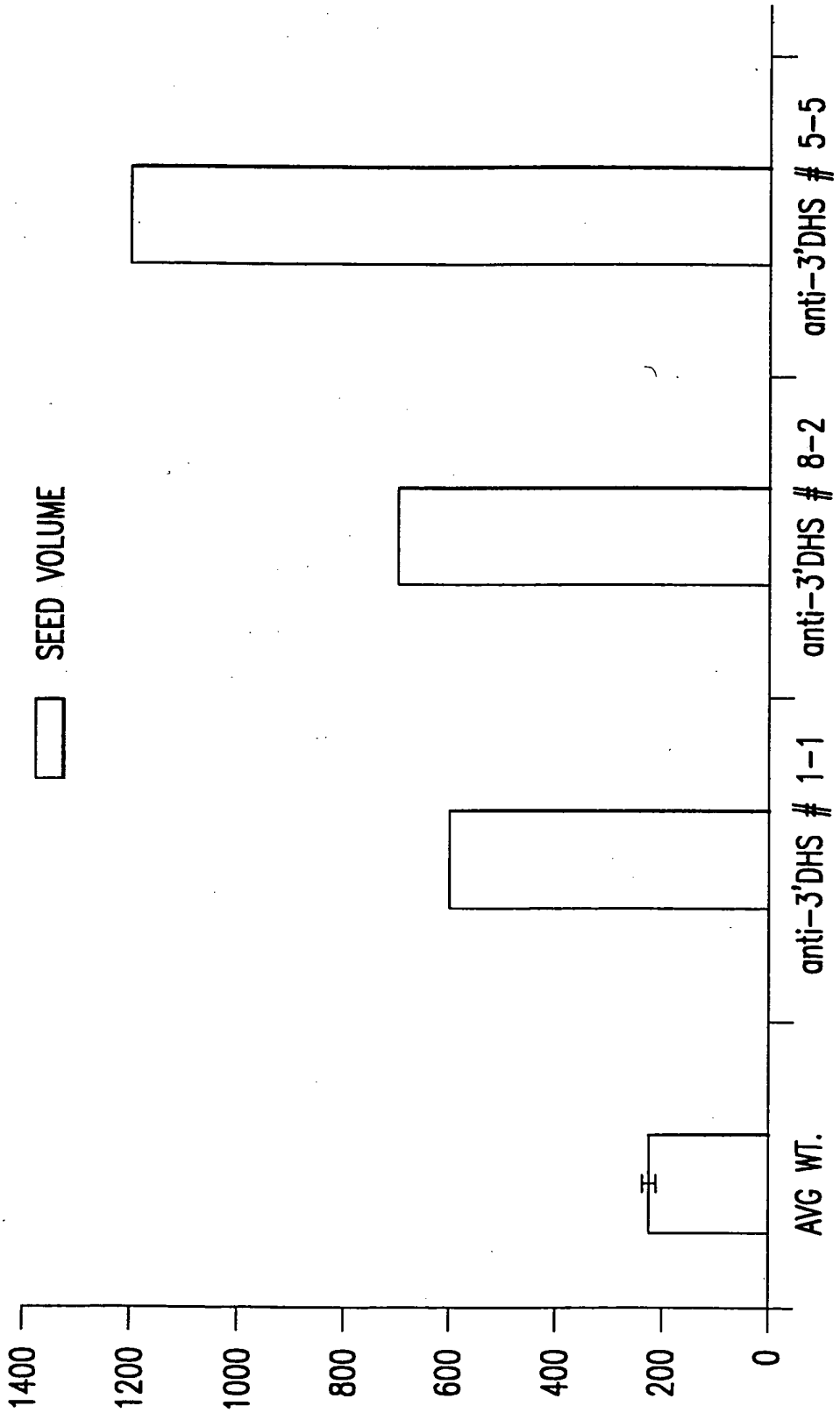

FIG.25

FIG.26

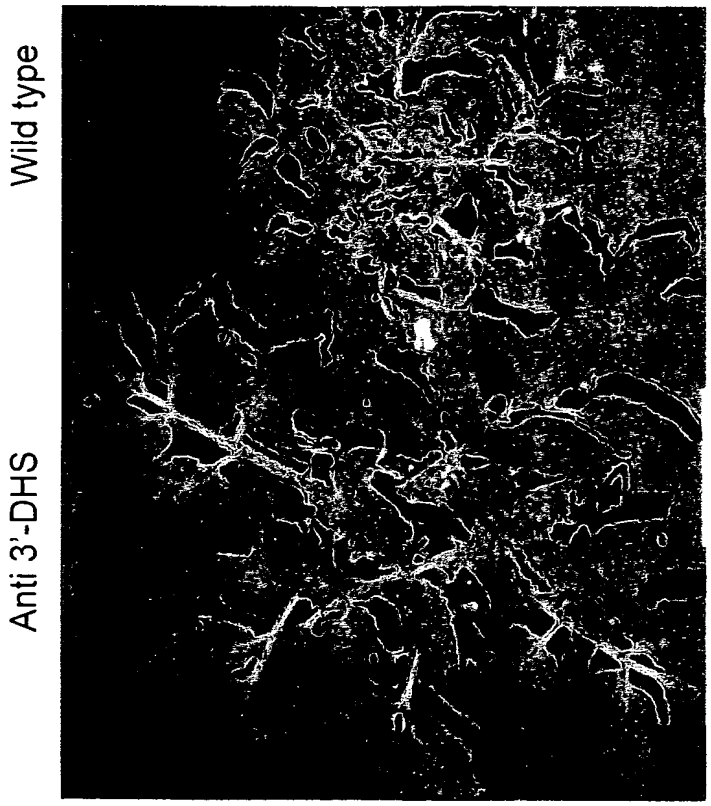

FIG.27

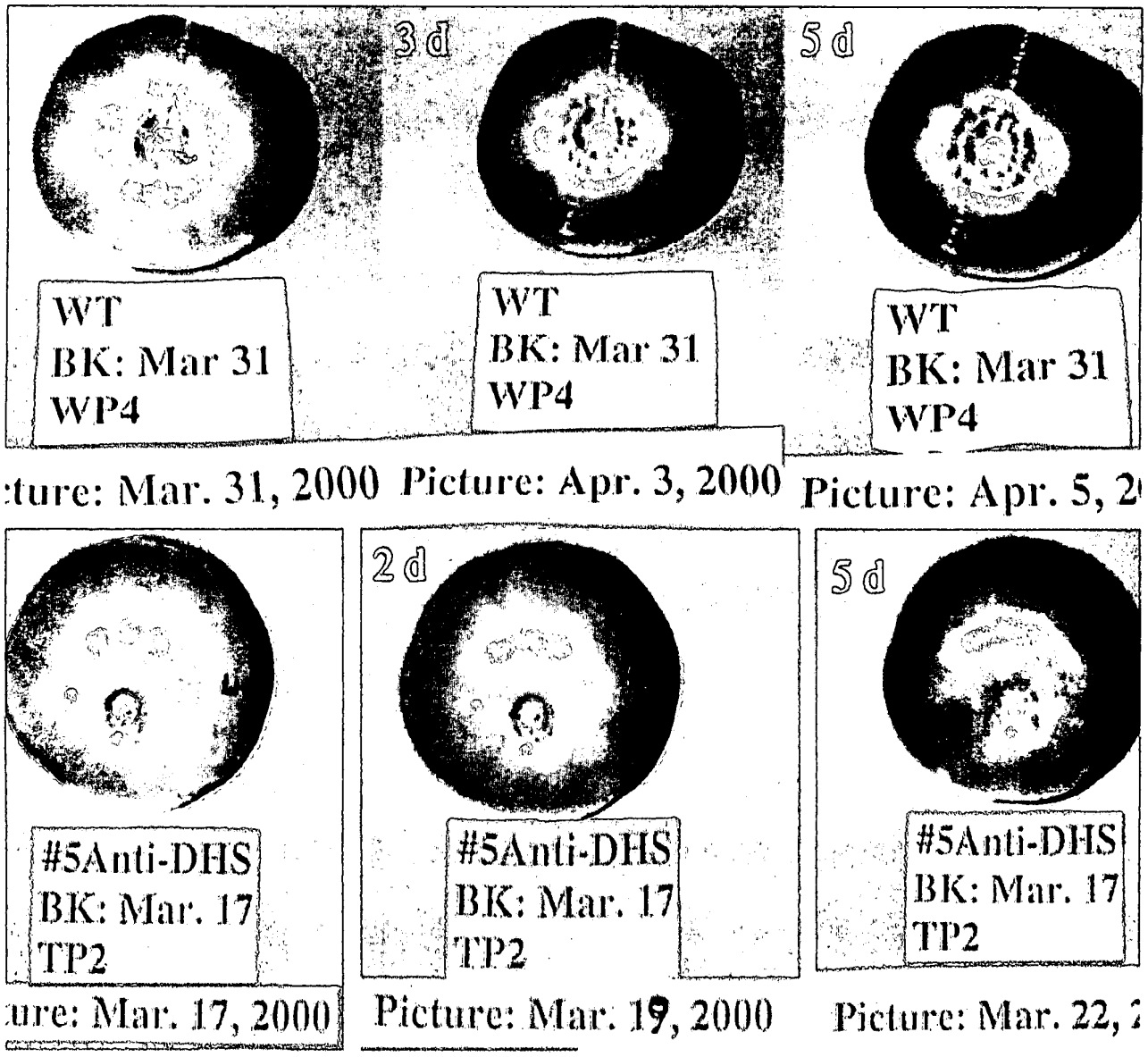

FIG.28

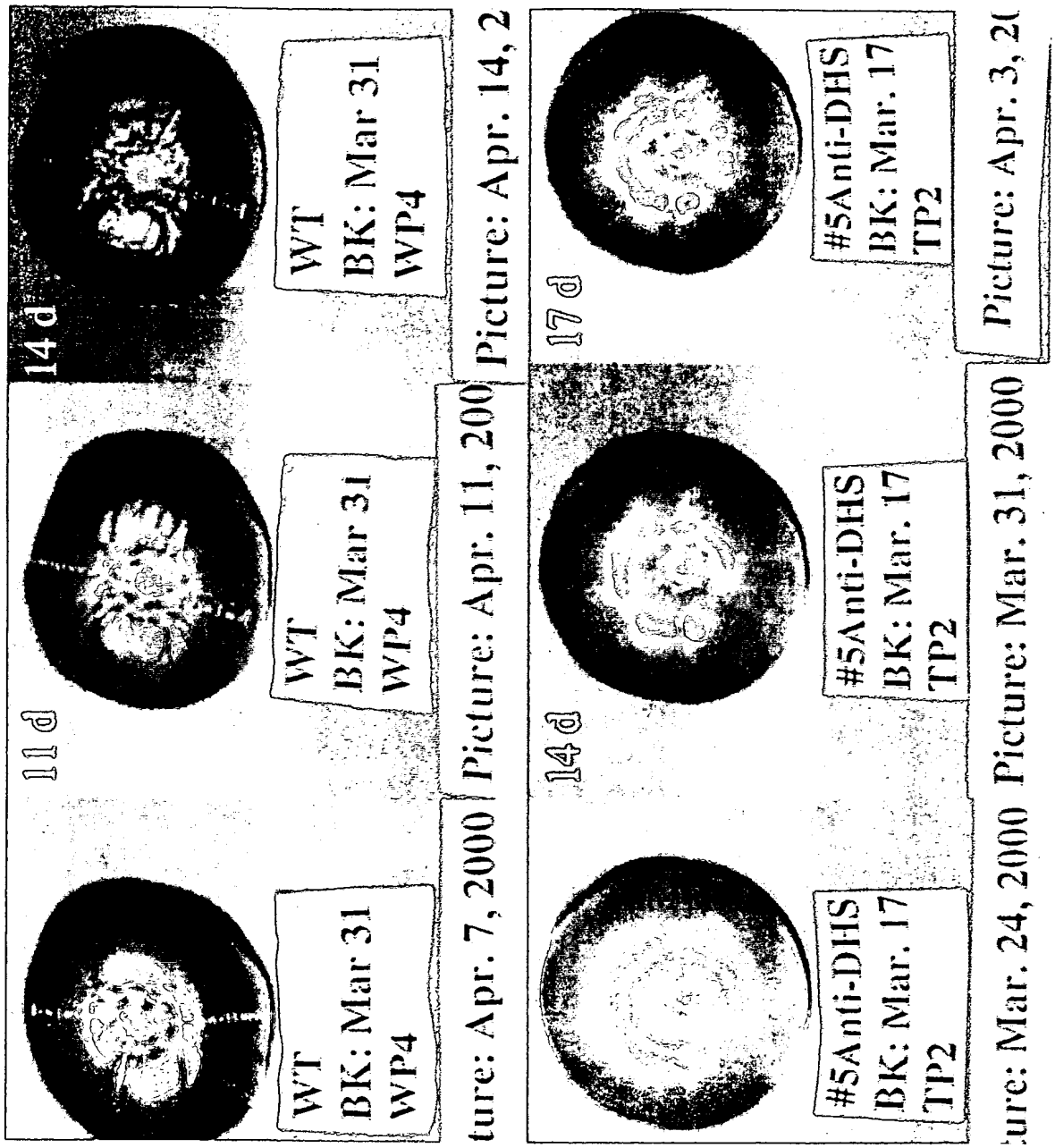

FIG.29

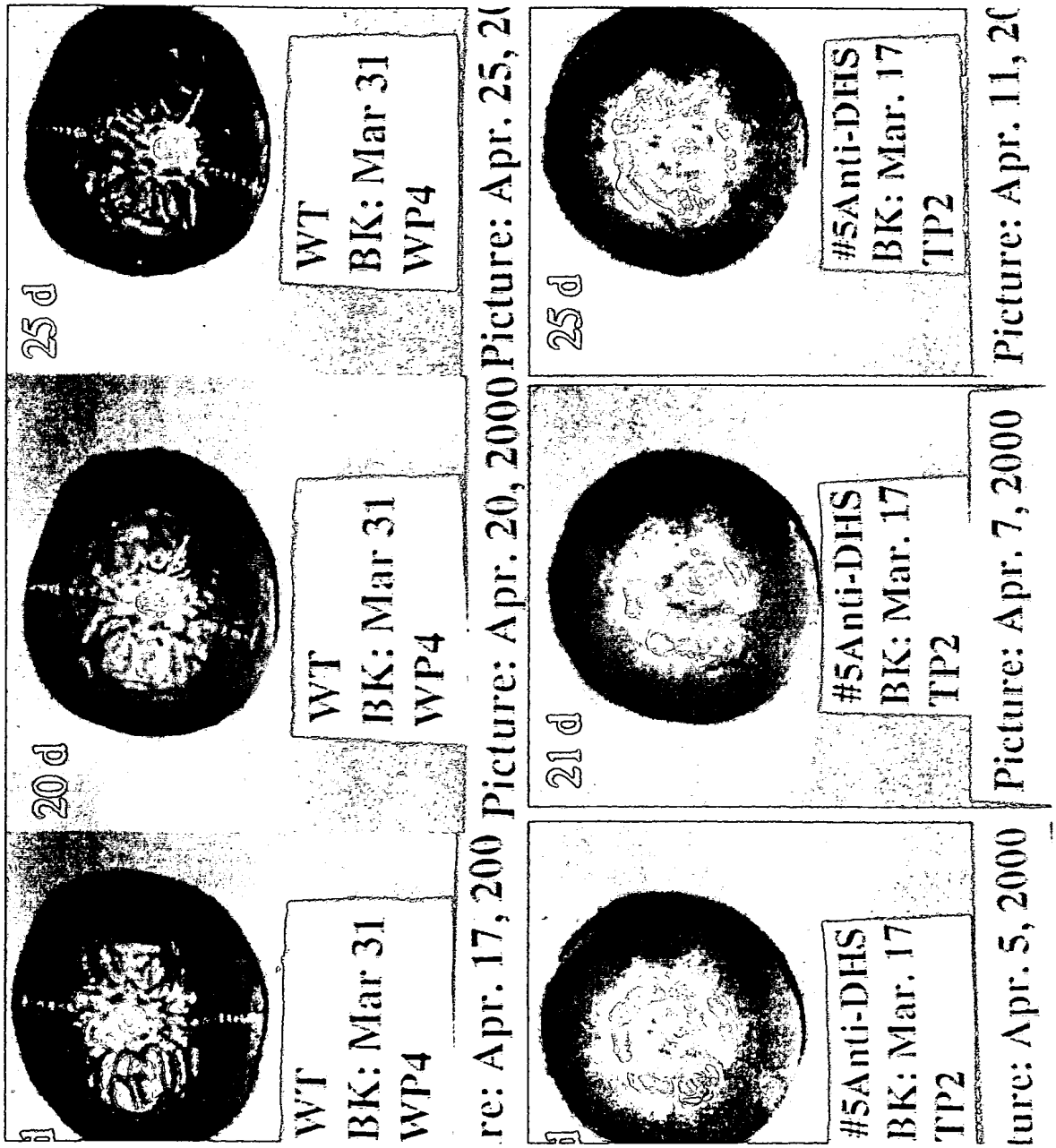

FIG.30

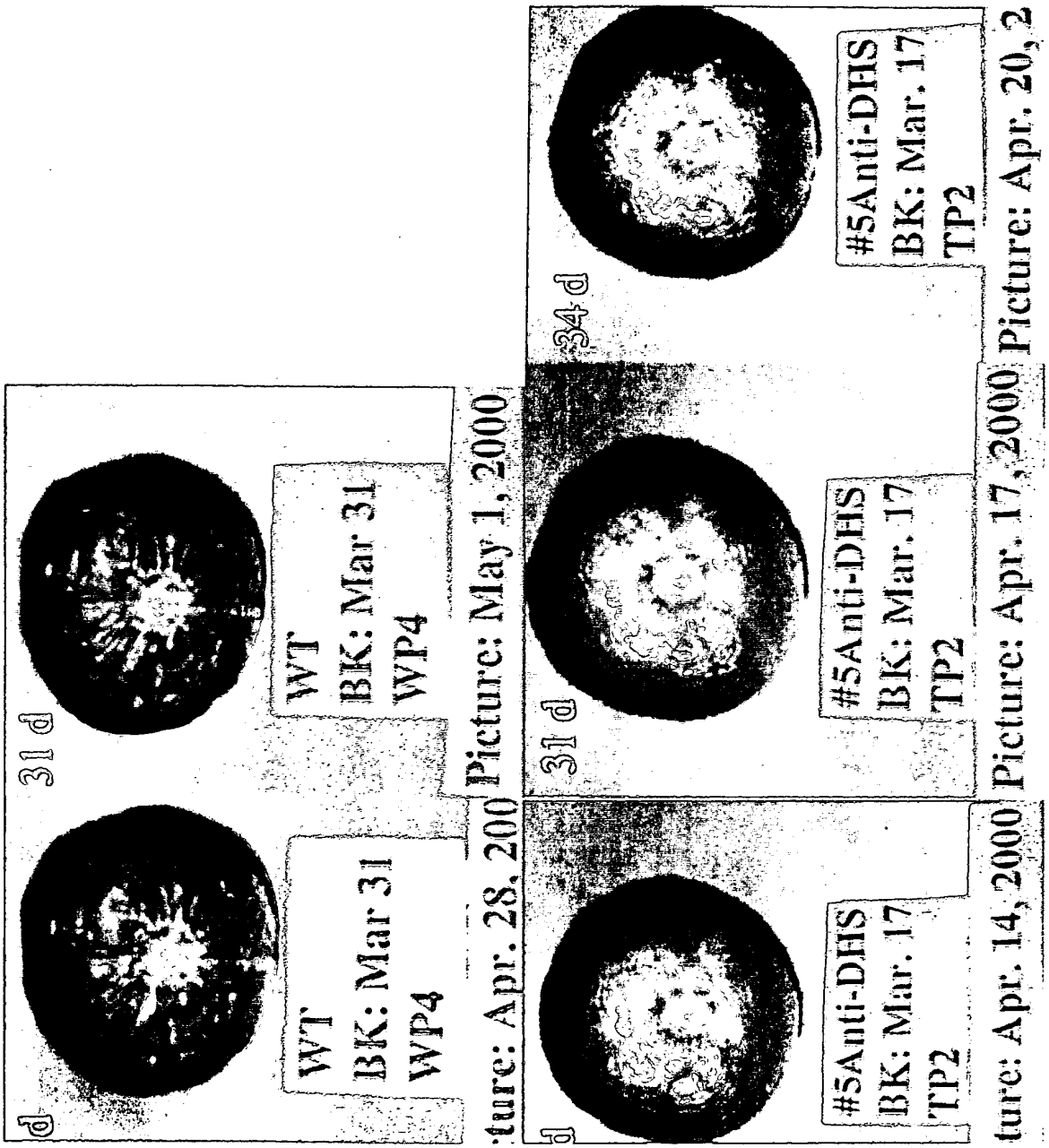

FIG.31

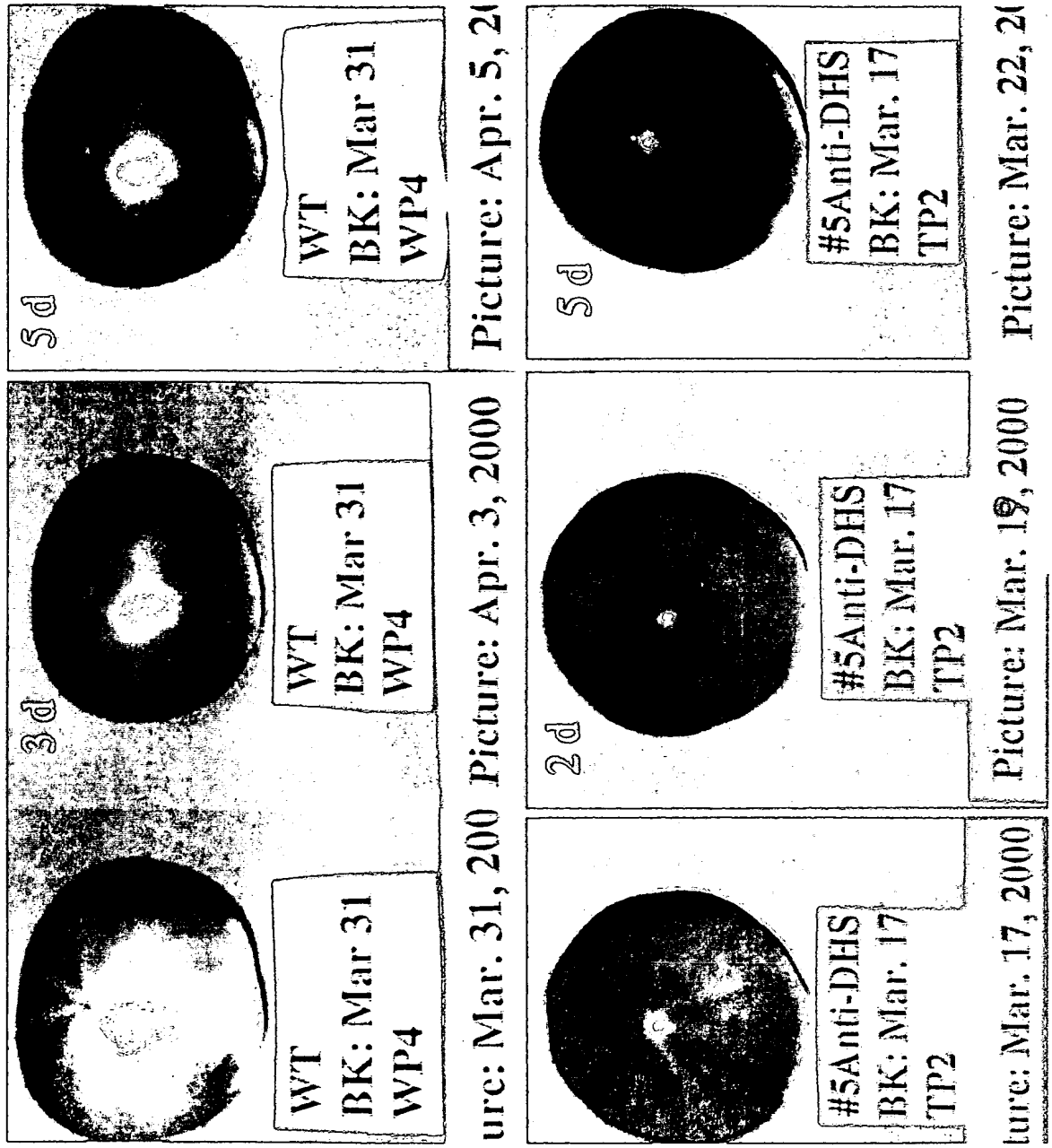

FIG.32

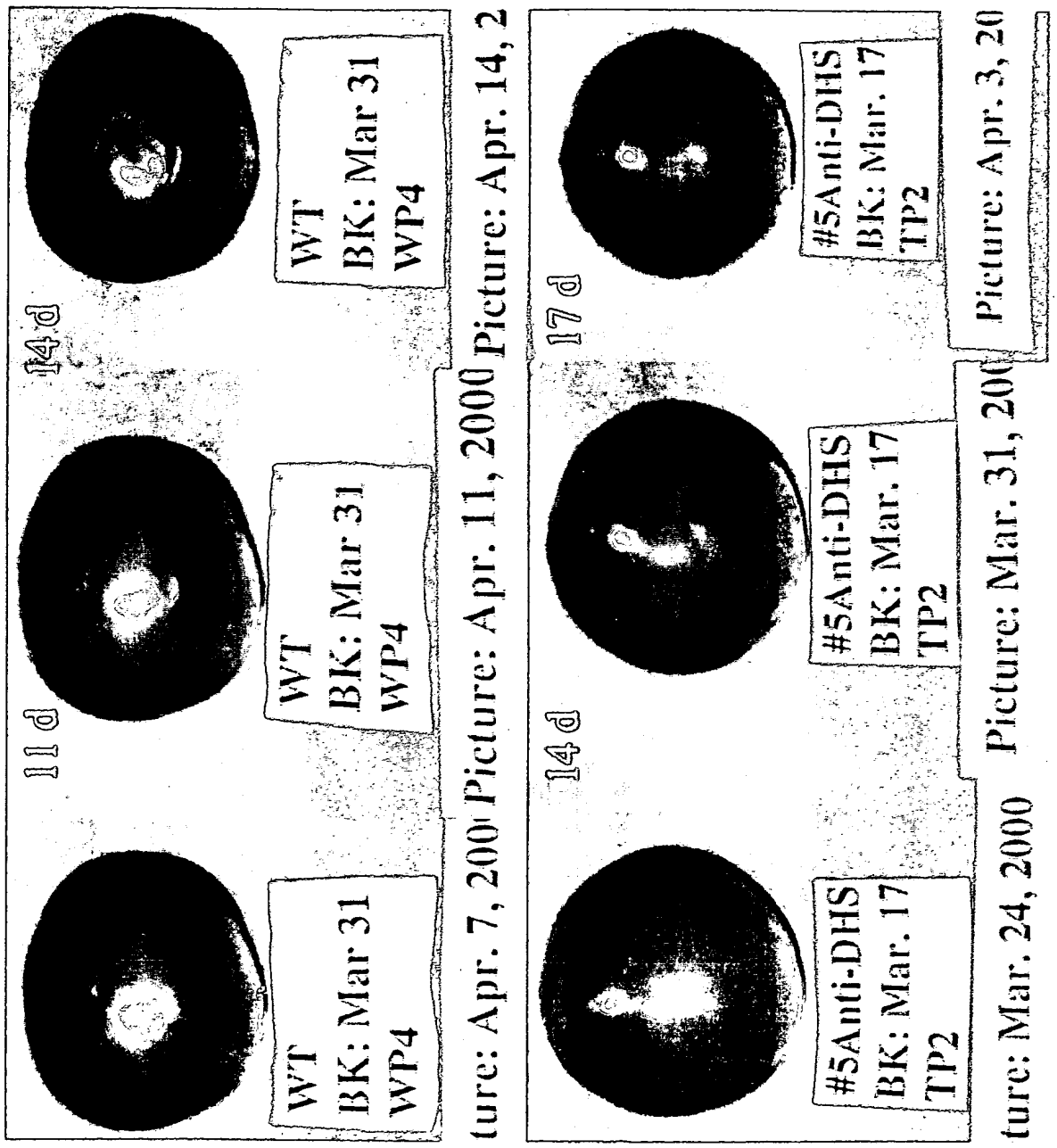

FIG.33

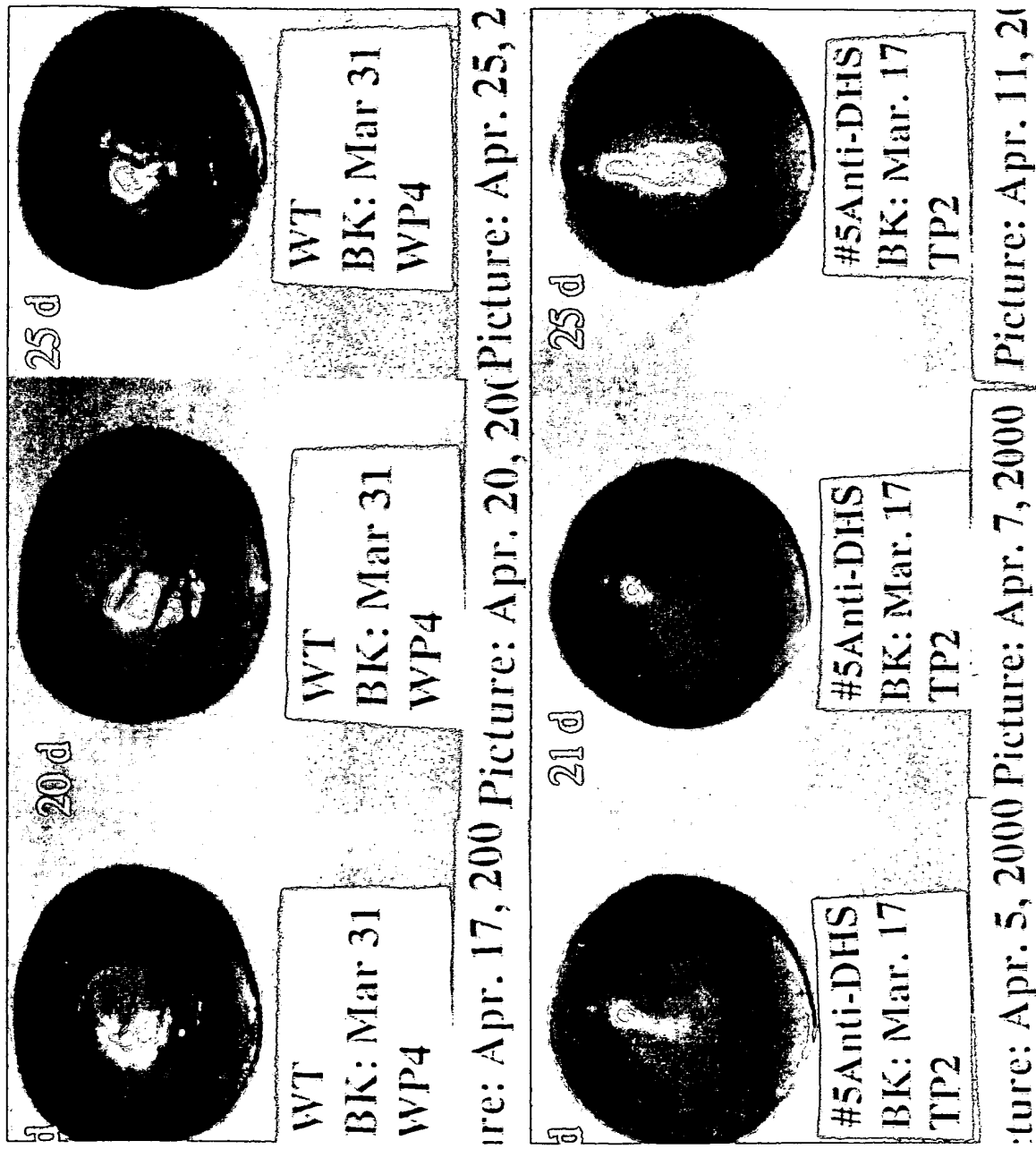

FIG.34

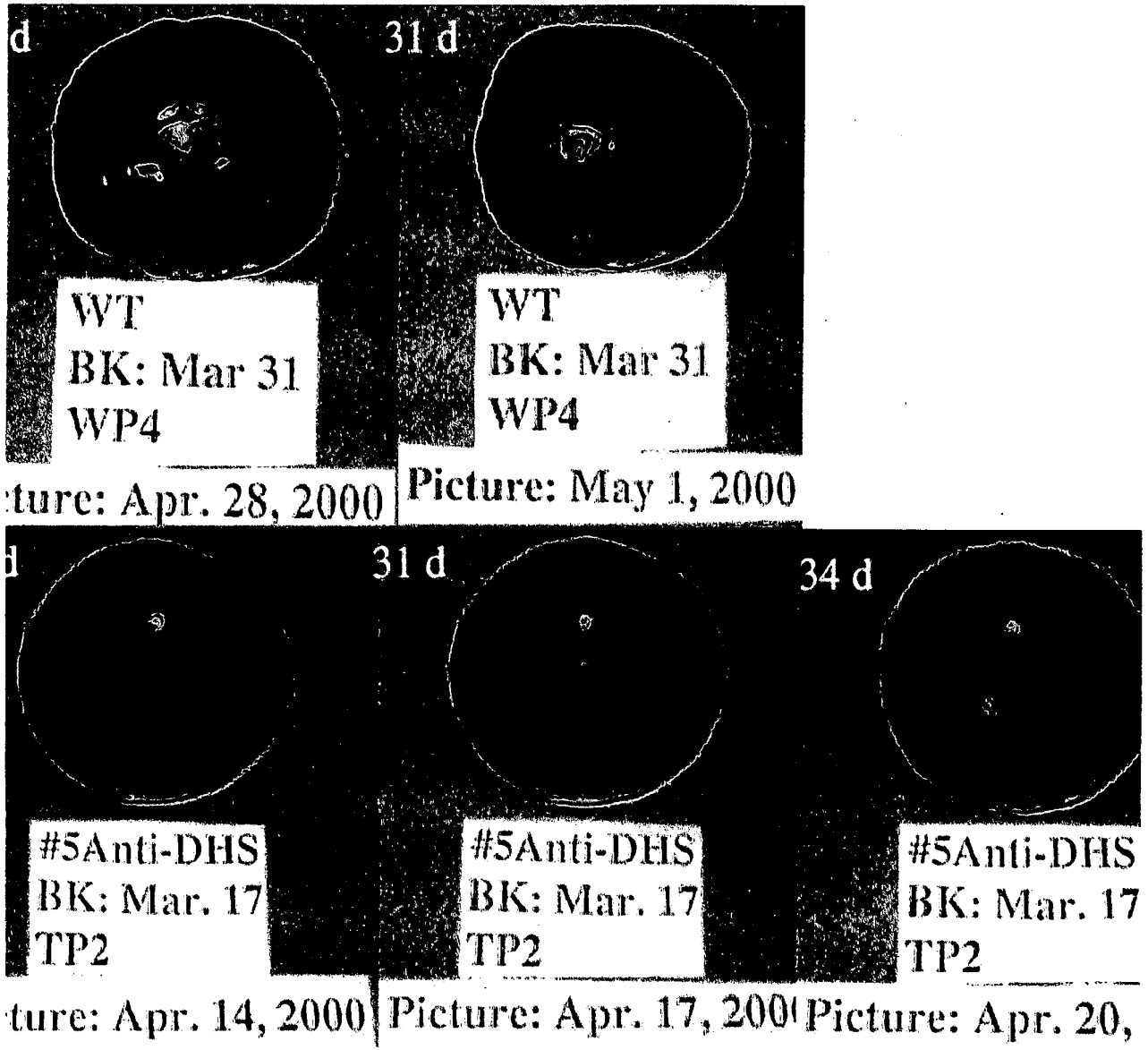

FIG.35

Arabidopsis 3'-end DHS for antisense

Nucleotide and derived amino acid sequence

TGCACGCCCTGATGAAGCTGTGTCTTGGGGTAAAATTAGGGGTTCTGCTAAAACCGTTAAGGTCTGCTTTT
A R P D E A V S W G K I R G S A K T V K V C F

TAATTTCTTCACATCCTAATTTATATCTCACTCAGTGGTTTTGAGTACATATTTAATATTGGATCATTCTT
L I S S H P N L Y L T Q W F

GCAGGTATACTGTGATGCTACCATAGCCTTCCCATTGTTGGTTGCAGAAACATTTGCCACAAAGAGAGACC
AAACCTGTGAGTCTAAGACTTAAGAACTGACTGGTCGTTTTGGCCATGGATTCTTAAAGATCGTTGCTTTT
TGATTTTACACTGGAGTGACCATATAACACTCCACATTGATGTGGCTGTGACGCGAATTGTCTTCTTGCGA
ATTGTACTTTAGTTTCTCTCAACCTAAAATGATTTGCAGATTGTGTTTTCGTTTAAAACACAAGAGTCTTG
TAGTCAATAATCCTTTGCCTTATAAAATTATTCAGTTCCAACAAAAAAAAAAAAAAAA

Nucleotide sequence

TGCACGCCCTGATGAAGCTGTGTCTTGGGGTAAAATTAGGGGTTCTGCTAAAACCGTTAAGGTCTGCTTTT
TAATTTCTTCACATCCTAATTTATATCTCACTCAGTGGTTTTGAGTACATATTTAATATTGGATCATTCTT
GCAGGTATACTGTGATGCTACCATAGCCTTCCCATTGTTGGTTGCAGAAACATTTGCCACAAAGAGAGACC
AAACCTGTGAGTCTAAGACTTAAGAACTGACTGGTCGTTTTGGCCATGGATTCTTAAAGATCGTTGCTTTT
TGATTTTACACTGGAGTGACCATATAACACTCCACATTGATGTGGCTGTGACGCGAATTGTCTTCTTGCGA
ATTGTACTTTAGTTTCTCTCAACCTAAAATGATTTGCAGATTGTGTTTTCGTTTAAAACACAAGAGTCTTG
TAGTCAATAATCCTTTGCCTTATAAAATTATTCAGTTCCAACAAAAAAAAAAAAAAAA

ARPDEAVSWGKIRGSAKTVKVCFLISSHPNLYLTQWF

FIG.36

Tomato 3'-end-Deoxyhupsine synthase used for antisense

Nucleotide and derived amino acid sequence

GGTGCTCGTCCTGATGAAGCTGTATCATGGGGAAAGATACGTGGTGGTGCCAAGACTGTGAAGGTGCATTGTGATGCAAC
G A R P D E A V S W G K I R G G A K T V K V H C D A T

CATTGCATTTCCCATATTAGTAGCTGAGACATTTGCAGCTAAGAGTAAGGAATTCTCCCAGATAAGGTGCCAAGTTTGAA
I A F P I L V A E T F A A K S K E F S Q I R C Q V

CATTGAGGAAGCTGTCCTTCCGACCACACATATGAATTGCTAGCTTTTGAAGCCAACTTGCTAGTGTGCAGCACCATTTA
TTCTGCAAAACTGACTAGAGAGCAGGGTATATTCCTCTACCCCGAGTTAGACGACATCCTGTATGGTTCAAATTAATTAT
TTTTCTCCCCTTCACACCATGTTATTTAGTTCTCTTCCTCTTCGAAAGTGAAGAGCTTAGATGTTCATAGGTTTTGAATT
ATGTTGGAGGTTGGTGATAACTGACTAGTCCTCTTACCATATAGATAATGTATCCTTGTACTATGAGATTTTGGGTGTGT
TTGATACCAAGGAAAAATGTTTATTTGGAAAACAATTGGATTTTTAATTTAAAAAAAATTGNTTAAAAAAAAAAAAAA

Nucleotide sequence

GGTGCTCGTCCTGATGAAGCTGTATCATGGGGAAAGATACGTGGTGGTGCCAAGACTGTGAAGGTGCATTGTGATGCAAC
CATTGCATTTCCCATATTAGTAGCTGAGACATTTGCAGCTAAGAGTAAGGAATTC

TCCCAGATAAGGTGCCAAGTTTGAACATTGAGGAAGCTGTCCTTCCGACCACACATATGAATTGCTAGCTTTTGAAGCCA
ACTTGCTAGTGTGCAGCACCATTTATTCTGCAAAACTGACTAGAGAGCAGGGTATATTCCTCTACCCCGAGTTAGACGAC
ATCCTGTATGGTTCAAATTAATTATTTTTCTCCCCTTCACACCATGTTATTTAGTTCTCTTCCTCTTCGAAAGTGAAGAG
CTTAGATGTTCATAGGTTTTGAATTATGTTGGAGGTTGGTGATAACTGACTAGTCCTCTTACCATATAGATAATGTATCC
TTGTACTATGAGATTTTGGGTGTGTTTGATACCAAGGAAAAATGTTTATTTGGAAAACAATTGGATTTTTAATTTAAAAA
AAATTGNTTAAAAAAAAAAAAAA

FIG.37

600 bp Arabidopsis Deoxyhypusine Synthase Probe

Primer1 (underlined)

GGTGGTGTTGAGGAAGATCTCATAAAATGCCTTGCACCTACATTTAAAGGTGATTTCTCTCTACCTGGAGC
TTATTTAAG
G G V E E D L I K C L A P T F K G D F S L P G A
Y L R
GTCAAAGGGATTGAACCGAATTGGGAATTTGCTGGTTCCTAATGATAACTACTGCAAGTTTGAGGATTGGA
TCATTCCCA
S K G L N R I G N L L V P N D N Y C K F E D W I
I P
TCTTTGACGAGATGTTGAAGGAACAGAAAGAAGAGAATGTGTTGTGGACTCCTTCTAAACTGTTAGCACGG
CTGGGAAAA
I F D E M L K E Q K E E N V L W T P S K L L A R
L G K
GAAATCAACAATGAGAGTTCATACCTTTATTGGGCATACAAGATGAATATTCCAGTATTCTGCCCAGGGTT
AACAGATGG
E I N N E S S Y L Y W A Y K M N I P V F C F G L
T D G
CTCTCTTAGGGATATGCTGTATTTTCACTCTTTTCGTACCTCTGGCCTCATCATCGATGTAGTACAAGATA
TCAGAGCTA

S L R D M L Y F H S F R T S G L I I D V V Q D I
R A
TGAACGGCGAAGCTGTCCATGCAAATCCTAAAAAGACAGGGATGATAATCCTTGGAGGGGGCTTGCCAAAG
CACCACATA
M N G E A V H A N P K K T G M I I L G G G L P K
H H I
TGTAATGCCAATATGATGCGCAATGGTGCAGATTACGCTGTATTTATAAACACCGGGCAAGAATTTGATGG
GAGCGACTC
C N A N M M R N G A D Y A V F I N T G Q E F D G
S D S
GGGTGCACGCCCTGATGAAGC
G A R P D E
Primer 2 (underlined)

FIG.38

483 bp Carnation Deoxyhypusine Synthase Probe

GAAGATCCATCAAGTGCCTTGCACCCACTTTCAAAGGCGATTTTGCCTTACCAGGAGCTCAATTACGCTCC
AAAGGGT
R R S I K C L A P T F K G D F A L P G A Q L R S
K G

TGAATCGAATTGGTAATCTGTTGGTTCCGAATGATAACTACTGTAAATTTGAGGATTGGATCATTCCAATT
TTAGATA
L N R I G N L L V P N D N Y C K F E D W I I P I
L D

AGATGTTGGAAGAGCAAATTTCAGAGAAAATCTTATGGACACCATCGAAGTTGATTGGTCGATTAGGAAGA
GAAATAA
K M L E E Q I S E K I L W T P S K L I G R L G R
E I

ACGATGAGAGTTCATACCTTTACTGGGCCTTCAAGAACAATATTCCAGTATTTTGCCCAGGTTTAACAGAC
GGCTCAC
N D E S S Y L Y W A F K N N I P V F C P G L T D
G S

TCGGAGACATGCTATATTTTCATTCTTTTCGCAATCCGGGTTTAATCATCGATGTTGTGCAAGATATAAGA
GCAGTAA

L G D M L Y F H S F R N P G L I I D V V Q D I R
A V

ATGGCGAGGCTGTGCACGCAGCGCCTAGGAAAACAGGCATGATTATACTCGGTGGAGGGTTGCCTAAGCAC
CACATCT
N G E A V H A A P R K T G M I I L G G G L P K H
H I

GCAACGCAAACATGATGAGAAATGGCGCCGATTATGCTGTTTTCATCAACACCG
C N A N M M R N G A D Y A V F I N T

A full-length cDNA clone was obtained by screening a carnation senescing petal cDNA library with this probe.

FIG.39

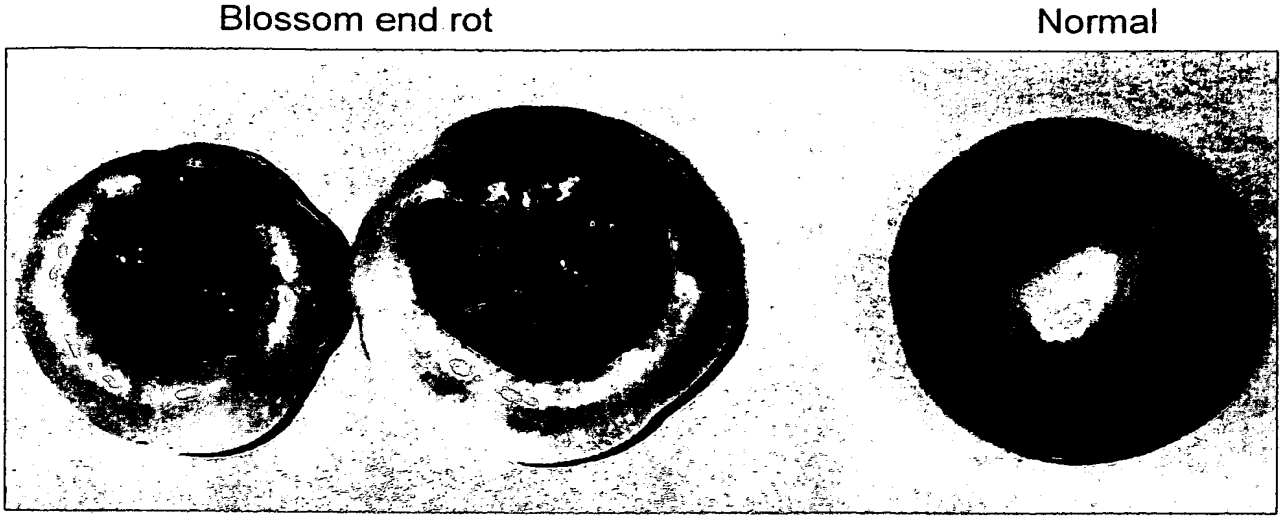

FIG.40A

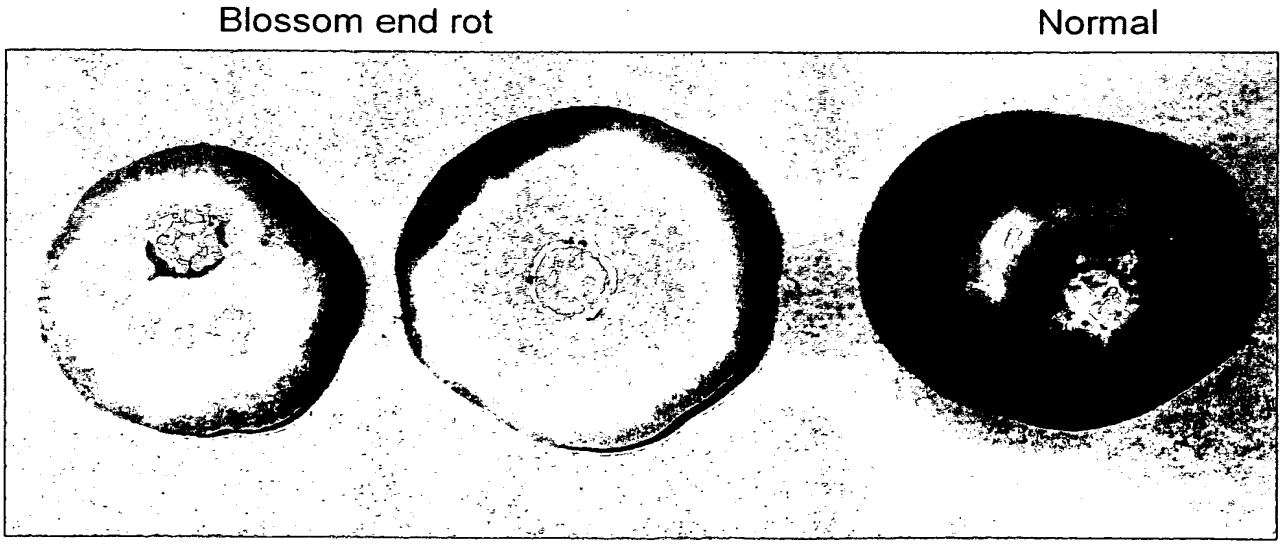

FIG.40B